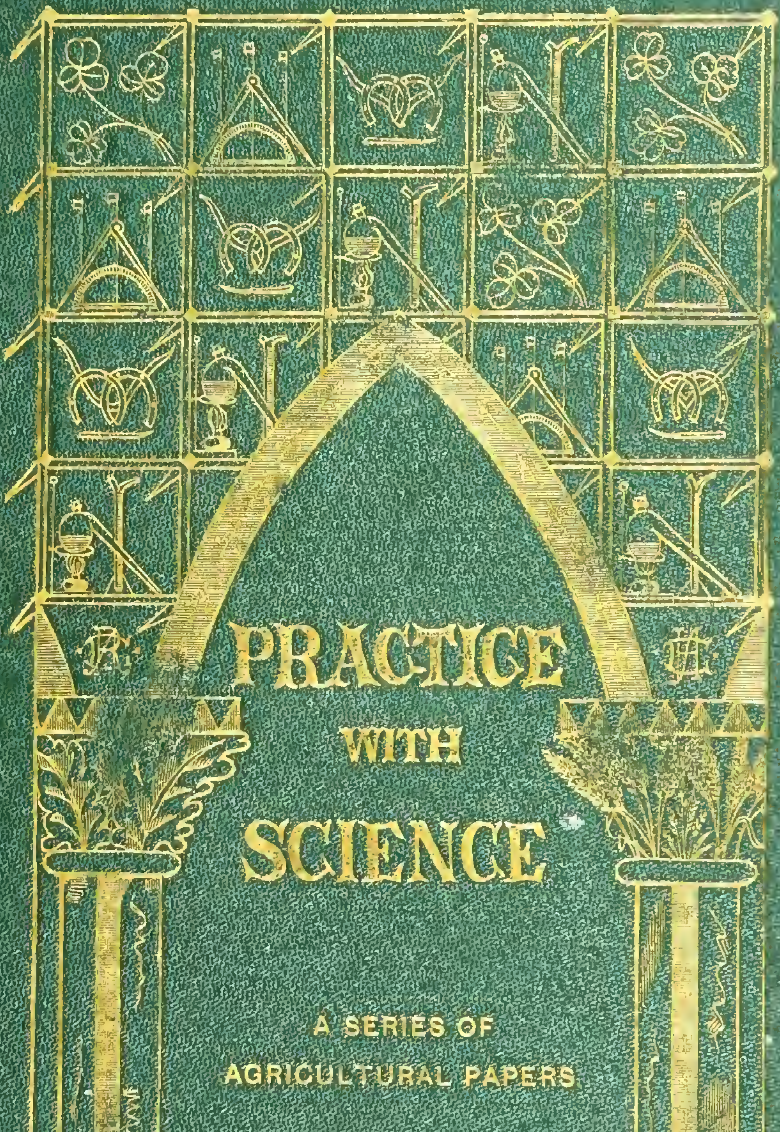

PRACTICE WITH SCIENCE

A SERIES OF
AGRICULTURAL PAPERS

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LAWS OF REAL PROPERTY AS AFFECTING AGRICULTURE.

IN TWO LECTURES.

LECTURE I.

In all ages, and in every country, the laws which regulate the succession to, and the distribution of, landed property, have had a most material effect in determining the agricultural condition of the soil. Land held in large masses by the actual possessors can never be managed in the same manner as small tracts. Thus where the circumstances are such as to render purely pastoral husbandry profitable or necessary, large areas are possessed by individuals. In Australia, for instance, and in the newest province, Queensland, leases are granted of not less than twenty-five nor more than one hundred *square miles.* While in certain districts of those colonies, and in all, as population increases, agriculture commences, and sections of eighty acres become the ordinary-sized farms of the tillage farmers. And although we may in our modern Australian colonies study the gradual development and progress of rural industry from the pastoral to the agricultural stage, according to natural economical laws,—for there men are free to deal with land according to the dictates of utility,—we must recollect, when applying such economical laws to our landed property at home, that a special and peculiar system, known as "the feudal," has greatly modified and fashioned the succession to, and the distribution of, land in England.

The general state of landed property here is this:—Large estates are held in apparent ownership by individuals who have only limited or particular interests therein; and such estates are more or less encumbered with charges of various kinds, and mortgage debts, which belong to other persons than the apparent owners of the estates. The beneficial enjoyment of these estates (beyond such portions as may be in the occupation of the proprietors) is derived from the rents paid by tenant farmers, to whom portions are let for cultivation. It is obvious that until the charges and the interest on mortgage debts are provided for, no part of the rents received can properly be made available for the personal use of the apparent owners of the estates. To state it more concisely, landed properties are usually encumbered, and are subject to settlements framed with a view to preserve each estate entire, however numerous and diversified may be the beneficial interests claimed therein. A short history of our modern entails or settlements is necessary to the full comprehension of this subject. As I mentioned in one of my lectures on leases, the feudal system, originally a military organization, is answerable for most of the anomalies which exist in our modern law of real property, and it is especially so with regard to entails or settlements.

Strict settlements, which now encumber and embarrass the landed property of this country,—and I will presently give you a practical illustration of what a "strict settlement" is,—were unknown to the simplicity of the common law. Substitutions by way of remainder were indeed permitted, that is, an estate might be given to A. for his life, with remainder (that is on his death) to B. or C., and the like. But as the particular estate, —*i.e.*, the life estate of A.,—could not have been by law greater than for life, this indulgence was productive of no injurious consequences. Land was not thereby tied up or rendered unavailable to the general use of its owners or the community. For in dealing with land laws and landed property we must keep constantly in our minds that whatever tends to restrict the power of each individual owner in the use or disposal of his land, affects, less or more directly, the whole community of which the restricted landholder is a member.

By the original law of England, though land might have been given to a man and his *lineal* heirs,—*i.e.*, sons and daughters, grandsons and grand-daughters, and so forth,—exclusively, or for an interest similar to an estate tail,—*i.e.*, to the heirs of his body,—yet after issue born his ownership became equivalent to a fee-simple for the purpose of alienation. The difference between a fee-simple and a fee-tail in the olden time was this :—If the estate was given to A. and his heirs, he had an estate in fee-simple, and he could immediately sell it; but if the estate was given to A., and the heirs *of his body*, or the heirs-male *of his body*, he had a fee-tail, which he could not dispose of until he had fulfilled the implied condition of the gift, namely, had a child born to him, where the gift was to the heirs (generally) of his body, or a *son*, where the gift was to the heirs-male of his body. But when that condition had been complied with by the birth of a child in the one case, or of a son in the other, the father—the donee or grantee of the estate—could sell or otherwise dispose of it as readily as if it had been originally granted to him in fee-simple. Practically no interest vested in the heir in tail, *i.e.*, the child, the different manner of limiting the estate being deemed only to affect the character of the father's interest in the property. Of course, if the father died without having made any disposition, the land would descend according to the form of the gift. I would gladly see our real property law brought back to its original simplicity, which, as I will hereafter show you, might be very easily accomplished, and that without the disturbance of any useful enjoyment of landed property.

On such a gift, that is, in fee-simple or fee-tail, no remainder could be limited, no valid interest could be given *after* a limitation of the estate to A. in fee or in fee-tail, but the *donor* or *granter* himself had a mere right or possibility of reverter, which right descended to his heirs, but was not alienable. This right of reverter only existed when the grant was made to A. and the heirs or heirs-male *of his body* (and not in fee-simple), when if A. never had any child in the first case, or any son in the second, upon his death the estate would "revert" or go back to the donor or granter, because A. had not complied with the condition of having an heir or an heir-male of his body. "Thus," as has been justly observed by one of our most eminent conveyancers, Mr. Hayes, "the modifications of property were few and free, tending to neither complexity nor perpetuity." And here I may notice a fact, well known to students of our earlier English laws, but not, perhaps, popularly known even amongst educated people, that while the judges and legal authorities were constantly so interpreting the law as to give the greatest possible freedom of action to the individual land-owner in the disposal of his land, the great feudatories and land-owners, then as now predominant in the Legislature, as constantly strove to render the law instrumental to the preservation of estates in the families of existing owners, though at considerable sacrifice of enjoyment to individual owners. The present benefit of the owners and of the community was rendered subservient to a system of territorial aggrandizement in the great families, and mainly of the heads of such families. The law in its simplicity, as I have described it, was in a great degree the work of the judges as the interpreters of the law, a state of things by no means agreeable to the great landed legislators. Accordingly, in the thirteenth year of the reign of King Edward the First, the

Statute of Westminster, and called "*de donis conditionalibus*"—concerning conditional gifts—was passed. This Act secured the succession to the issue of the donee in tail, and the reversion (in case there should be no issue of the donee in tail) to the donor; the right of the donee to alien the property after issue born was thereby wholly taken away. "Thenceforth," says Mr. Hayes, "a limitation to a man and his lineal heirs, or in other words, to a man and the heirs of his body, created a particular estate, on which remainders over, for life, in tail, or in fee, might depend; if the fee was undisposed of, it continued in the donor, not as a precarious right or possibility of reverter, but as an indefeasible estate in reversion, which he (the donor) might again impress with similar limitations."

"This Statute, therefore, though it did not actually create the species of disposition called a gift in tail, yet confined its operation within the very terms of the gift, and so laid the foundation of a strict settlement, *without providing any means of breaking the fetter and restoring the land to commerce.*" This Act therefore established, or rather was intended to establish indestructible entails of land, which, wheresoever they have existed, have been found most mischievous, by interfering with the natural use and disposal of land, which the ordinary wants and exigencies of mankind would otherwise have induced. But this movement by the *Legislature* towards restriction was met by a counter-movement of the judicature towards freedom. The judges very early adopted the sound maxim, "*that the law abhors a perpetuity,*" and every faculty of the legal mind was bent to defeat the Statute, which was intended to render the perpetual entails, so abhorred of the law, the universal rule. It was thus accomplished. In early times a fictitious suit in the Court of Common Pleas, called a "RECOVERY," was used to gain a title to land, under the sanction of a solemn proceeding or record, and a title thus gained being the result of a judicial proceeding could not be questioned either by heirs in tail, or by donors or their heirs claiming the estate in reversion, *i.e.*, on the extinction of the heirs or lineal descendants of the donee. By the time of Edward the Fourth COMMON RECOVERIES were employed for enlarging an estate tail into an estate in fee-simple, and soon came to be considered common or ordinary assurances. Though the suit in which the "recovery" of the land intended to be transferred was suffered by the one party and obtained by the other, was purely fictitious, yet being sanctioned by the judges, resulting in a judgment of recovery, was held as binding, as if the estate had been recovered in a suit really adverse. This mode of assurance or conveyance could not be adopted by a tenant in tail in remainder, without the concurrence of the person entitled to the immediate freehold, usually the tenant for life of the estate; but when the tenant in tail was in possession, or could obtain the concurrence of the lifeholder, he had an effectual though somewhat inconvenient remedy for getting rid of, technically barring, the entail which the Statute *de donis* had intended to render indestructible. Subsequently an Act of Parliament, 32 Hen. VIII. c. 36, gave to a fine—another sort of fictitious suit also used as a means of conveying land—when levied by a tenant in tail the effect of absolutely excluding the issue in tail, as such, from the succession, and of diverting the land for the time of the continuance of such issue into the ordinary channels of descent and alienation. Here the astuteness of the lawyers was successfully exerted in the interest of the public, and land again was freed from fetters of perpetual entails, which a landowning legislature had endeavoured to impose. I need scarcely tell you that this is a bare outline of the very complex and technical law of real property from the time of the Statute *de donis*, 13 Ed. I. to the 32 of Hen. VIII. During that long period, the complication of the law was extreme, and as the old law reports tell us, disputes and questions of great difficulty, calling forth a prodigious amount of legal learning, frequently arose. Mr. Hayes tells us that "each step subsequent to the Statute *de donis*, was an effort to recover the liberty of alienation, but by pursuing that object without method, by employing different devices, with various kinds and degrees of operation, the law became entangled among subtleties and forms hardly less injurious than the perpetuity it abhorred. The wrong assurance was adopted, or the technical requisites were not duly observed, and the effect upon the title of the blunder or omission was overlooked or misconceived." At this time the rule against perpetuities was somewhat undefined by the courts. Nothing more definite than that this postponement of the power of alienation must be confined within *reasonable* limits had been judicially laid down. But the courts of law, in their desire to promote the free interchange of property, gave to a tenant in tail the power, by means of a fine or recovery, of enlarging his estate, however circumscribed or defeasible, into a fee-simple absolute, and such right of enlargement was inseparable from an estate tail.

There were other legal effects attributed to a fine or a recovery, which, to state, would lead me too much into legal technicalities, but which may be said in a general way to operate to bar conditions, remote contingencies, or claims, which would have interfered with the power of free disposition of his land, to which every proprietor was considered entitled. There is another rule of law, technically known as "the rule in Shelley's case," laid down by the judges at an early period, which had considerable effect in removing the fetters of entails. This rule says, and in effect, " that if an estate of *freehold* [*i.e.*, a life estate] be limited to A., with *remainder* to his heirs, general or special, the remainder, though importing an independent gift to the heirs, as original takers, shall confer the inheritance on A., the ancestor. The effect of the rule may, for our present purpose, be stated to be to render A. the ancestor to whom, *in form*, a life estate only was given, with a remainder to his heirs, or the heirs of his body, at once the owner either in fee or in tail, just as if the gift had been to him and his heirs, or the heirs of his body. The practical result was, that the ancestor could immediately dispose of the estate if the limitation was to his heirs, or he could forthwith acquire the absolute fee-simple, if the limitation was to the heirs of his body. It is on what I may venture, as an economist rather than a lawyer, to call an evasion of the law as laid down by the rule in Shelley's case, that the whole of our modern system of strict settlements depends. Thus, the rule in Shelley's case was held to apply only to the case where land was limited to A. for life, with remainder to his HEIRS, general or special; but where the limitation was to A. for life, with remainder to his *sons* or *children*, to take either as individuals or as a class, under what is termed a personal description, as distinguished from a limitation embracing the line of inheritable succession, the rule had no concern whatever. Acting upon this distinction, Orlando Bridgeman, a conveyancer of the time of Elizabeth, invented the limitations of land which form substantially our modern settlement. What that settlement is I shall presently state.

From the preceding brief sketch, you will see that, with the exception of a general and persistent purpose on the part of the feudal landowners to restrict the power to dispose of land, and an equally general counter-purpose on the part of our courts of law to give facility to the disposition of land, and to prevent it from being, as the old phrase was, "withdrawn from commerce," that is from practical usefulness, design, or plan, had but little part in settling our law of real property. To use Mr. Hayes' words, in concluding a far more elaborate sketch than I dare to offer to a non-legal audience,—"From this sketch it will appear how small a portion of our law of real property was the result of design. Institutions, stern and oppressive in their origin, gradually yielded to the progress of opinion, accident favouring, and the judicature abetting the diffusion of a more grateful policy. While fraud and fear, the cupidity of monks, and the turbulence of barons, seeking shelter from the restrictions of mortmain or the penalties of treason, laid the foundation, the growing spirit of freedom availing itself of legislative imbecility and technical astuteness, reared the superstructure of that mixed system of legal and equitable interests, which, however elaborate in its machinery and subtle in its abstruser doctrines, proved adequate in the great mass of transactions, as well to satisfy the wants, as to indulge the wishes of a highly cultivated people." It is with a view to aid in the formation of opinion, which must ultimately break down the modern system of strict settlement, so obstructive to the best and most productive use of landed property, that I propose to describe to you (1.) what that system is; and (2.) how it operates to impede the development of husbandry, and to lessen the value of agricultural land.

I have before mentioned the legal maxim, that "the law abhors a perpetuity." And what is called "the rule against perpetuities" has now been fixed by repeated decisions of the judicature with a considerable degree of, if not with complete, precision. For our present purpose, however, the rule is sufficiently precise, and it forms the general land-mark which bounds the proprietary right on every side, and governs the whole doctrine of settlement. The rule is this, that property may be limited to any person, or any number of persons actually in existence (and in that term is included a child in *ventre sa mère*) for life, and twenty-one years afterwards; but that any limitation which must, or which, in contemplation of law, *may* exceed that period, is beyond the rule, and is absolutely void. And this rule is an inflexible law. However widely the modification of property may differ among themselves,—yet, as regards the suspension of the disposing power, they have this common and impassable limit. This rule puts a limit to that species of family vanity which, in the quaint language of a former chancellor, Lord Nottingham, "fights against God, by affecting a stability which human providence can never attain to." To put the rule into a popular form, I may say that a settler—*i.e.*, one who desires to create a strict settlement—may limit the property to A. for his life, with remainder after A.'s death to his first son (A. having then no son, or being perhaps himself a newly-born infant, or in *ventre*) in tail, but he cannot go on to limit the property to A.'s unborn son for life, with remainder to his (the unborn son's) heirs in tail, nor to the unborn son on attaining twenty-two years or more, because such further limitation would offend the rule against perpetuities, and be void. The practical effect is, that any estate limited to a person not in being at the time of making the settlement must be an estate tail; and inasmuch as the power of acquiring the absolute fee-simple is inseparably annexed to every estate tail, such unborn person, when he comes into existence and attains the age of twenty-one years, will have the power of barring the entail, and defeating all the subsequent limitations,—in a word, of putting an end to the settlement altogether.

Of course the power of absolutely getting rid of the settlement can only come into operation when this unborn person—tenant in tail—shall come into actual possession of the property by the death of the preceding tenant for life. But the tenant for life and the tenant in tail, by concurring together in the necessary legal formalities, may also put an end to the settlement; and it is in this way, and by re-settlement, as we shall presently see, that under the modern system strict settlements are constantly renewed, and the fetters on disposal perpetuated. Mr. Hayes, in his learned note on the rule against perpetuities, truly says:—"Within, or at the end of the period allowed by the rule, incapacity to alien the absolute interest, so far as the disabling effect of the instrument (the settlement) is concerned, must determine; *though the actual exercise of the disposing power may be prevented for centuries by a succession of disabilities created by law.*" Or, as is more commonly the case, the settlement may be determined and immediately renewed as each tenant in tail attains his majority.

I will state, as shortly as I can, the ordinary terms of the strict settlement of a large estate, the one I have especially in my mind being the settlement made on the marriage of a nobleman, which was drawn in the chambers of an eminent barrister long retired from the bar, and whilst I was one of his pupils. The Earl of A. had acquired the absolute fee-simple in his estate by the legal destruction of all prior settlements; and was therefore free to deal with it, by sale or otherwise, as he might think fit. It is possible, and I believe it was the fact, that the estate was subject to mortgage debts, which had grown out of prior settlements. Being about to be married, the estate was to be subjected to a strict settlement; that is, the power of absolute disposal was to be suspended for the longest periods allowed by law. By deed the Earl of A., granted all his large and numerous estates, which were fully described, to two trustees, for the term of 100 years, upon trust, to raise during the life of his then intended wife an annual sum, say £500, for her sole separate use, as pin-money, to be enjoyed by her without any control over it by her husband or his creditors. Next the estates were limited to two other trustees for the term of 1000 years, the purpose of which was declared (in a subsequent part of the deed), to be for raising portions for the younger children of the intended marriage, to the extent of say £20,000 if only one younger child; £30,000 if two; and £40,000 if there should be three or more younger children. The object of this mode of settlement is that the sum to be raised upon the estate for the portions of the younger children should be a charge prior and paramount to the interest of the eldest son of the marriage, who was intended to take the estate charged with the sum of £20,000, £30,000, or £40,000, according to the number of his younger brothers and his sisters. Next, the estates were limited to the Earl himself for his own life, without impeachment of waste—that is, he might cut timber, pull down houses, break up pasture land, and the like, without being called to account for it, or stopped by other persons interested under the settlement, his eldest son, for instance; and he therefore would be life-tenant of the property, subject to the charges of his wife's separate pin-money, and (whenever he chose to direct it to be raised) the £20,000, £30,000, or £40,000 for the benefit of his younger children. This latter charge would probably come gradually into operation as his sons required to be advanced in life, and his daughters to be married. Before his death, the whole or the greater part would most likely have assumed the form of a mortgage on the property, the interest of that would have to be kept down by the

Earl out of his life income. Next in order was a limitation of all the estates to a third set of trustees for another term of years, upon trusts, for raising the jointure of say £3000 per annum of the intended wife, which she was to receive during her life in case she should survive the Earl, her husband. Then (omitting various limitations to trustees to preserve contingent remainders as mere technicalities, not necessary to be mentioned for our present purpose) came a limitation to the first son of the intended marriage, as the heirs of his body begotten in tail male. Here the disabling effect of the settlement would end, in case the Earl should leave a son who should attain the age of twenty-one years (which, I believe, has happened), because father and son together could join in barring the entail and all subsequent remainders, and so put an end to the settlement. Of course this extinction of the settlement would not interfere with the charges for the Countess's pin-money, the portions of the younger children, or the jointure of the Countess, should she survive the Earl, all of which must remain charges on the estate. But, subject to those charges, the Earl and his eldest son could acquire the means of disposing of the estates, and barring all the subsequent limitations to which I am about to draw your attention. Well, then, after the limitation to the first son of the marriage in tail, there were remainders over to the second son of the marriage in tail, remainder to the third son in tail, and remainders to the fourth, fifth, and every other son of the marriage successively in tail, according to their respective seniorities. Thus, if the eldest son should die under age, his next brother would take the estates as tenant in tail, and so throughout the sons in succession, until one of them should live to attain his majority, when, with his father, he could bar the intail. But in default of sons of the marriage—practically if no son should live to the age of twenty-one—the estates were limited to the Earl's next brother B. for his life in the same way as to the Earl, then to his (B.'s) first, second, and other sons successively in tail, then, in default of such issue, to the Earl's second brother C. for his life, with remainder to his first, second, and other sons in tail, then to the Earl's third brother D. for his life, with remainder to his first, second, and other sons in tail; and finally, there were successive limitations to several of the Earl's cousins for life, with remainders to the first and other sons of each cousin in tail. It will be observed that, in the limitations of the estate, daughters are altogether ignored. But then in case all the male issue of all these living males of the family should fail, the estate was limited back to the Earl's eldest, second, and other daughters successively in tail, and in case of failure of daughters of this Earl and their issue, limitations were made in like manner to the daughters of each of his before-mentioned brothers and cousins in succession, with an ultimate limitation to the Earl's right heirs. Then to each person made tenant for life is given a power, when in possession, to charge the estate with a jointure for his wife, and with a defined sum by way of portions for his younger children. It is obvious that the main purpose of such a settlement is to keep the corpus of the estates in the hands of one person, the male head of the family, so long as any male might be in existence, and then to the female head of the family, as long as possible, and to provide for all the family requirements of widows, younger children, and so forth, by means of annual charges and mortgages. Now it so happened that this estate, when thus settled, was subject to some heavy mortgages, the results of some such previous settlements as I have described, and these mortgages remaining, the widows' jointure and the

£40,000 raised for younger children, the Earl's eldest son surviving his father, and coming into possession of the estates, will find himself the nominal owner of a large territory, with all the obligations, real and ideal, which that position imposes. All the expenses of management, including the occasional costs of paying off mortgages which may be called in, and of borrowing the money from other persons, will fall upon him, while his actual income, applicable to his own personal use, bears a small proportion to his nominal income. In short, he is to a large extent a mere receiver for others, yet he has out of his own share of the income to provide for all the incidental and contingent expenses of a large and encumbered property. Let us trace the operation of such a settlement on the property which is subject to it under two or three of the contingencies which may happen to the family. Suppose the Earl to incur debts which he cannot defray out of his income (an event by no means rare amongst landed proprietors), he will wait until his eldest son attains his majority, when, as father and son, acting together, can bar the in tail and destroy the settlement, it will be easy to charge the father's debt upon the estate. Then by the time the eldest son has attained twenty-one, knowing that if he lives he must succeed to a large estate, and that fact being also well known to others, he also has probably incurred some debts during his minority, which, as a man of honour, he desires to pay. Indeed, one of the evils of the system of settlement is that the eldest son has great temptation to anticipate his future resources, and great facilities for so doing, though he has always to borrow at high rates of interest, from the possibility of his dying in his father's lifetime, without any arrangement having been made to charge such debts on the estate. He borrows, consequently, with a great ultimate sacrifice. An old friend of mine, now dead, a solicitor, told me that he was once consulted by a former Duke of Marlborough, the last Duke but one, and I believe the grandfather of the present Duke, on the subject of his affairs, which were then hopelessly embarrassed, when the Duke stated, that at the time he attained his majority he owed £500,000, and that he had not received value for more than about one-fifth part of that sum. The rest was made up of interest, compound interest, and law charges. Of course this was an extreme case, but on a more moderate scale the same thing is common enough. Well then, suppose this Earl to have some debts, and his eldest son to have some debts, when the son attains twenty-one, the course they adopt is to join in abrogating the old settlement, so far as the son's estate tail is concerned, and all the subsequent limitations, to charge the father's debt and the son's debt on the estate, probably to give the son some annual income out of the property during his father's life, and then to re-settle the estate, pretty much in the same way as it was settled before, with this difference, that the son under the new settlement takes a life estate only, the first estate in tail being limited to his first (then unborn) son, second son, and so on, with remainders to his brothers; then, probably, to his father's brothers, cousins, and the rest of the family, as in the old settlement. Then the Earl dies, leaving his widow, his eldest son, and three or more younger children, surviving him. Let us see what is the position of the eldest son on succeeding to the estate. His mother has her jointure of £3000 a year out of the income; there is the old debt charged on the estate when the Earl made his marriage settlement; there is the levy of £40,000 raised for the portions of his younger children; there is the father's debt, and the son's debt, both charged on the estate when it was re-settled, the aggregate amount of which may be a large sum. Hence the son's real income, as compared with his nominal income, the gross rental of the property, is a small one, and if he intends to free his estate from encumbrances, he must live a single and a saving man, or he must marry a rich wife. But perchance he is unwilling to do either, so he marries a lady of his own rank, with only the moderate portion of a younger child. Then, in due course of time, another jointure, other portions for another crop of younger children, come as charges on the estate, none of the old charges, be it observed, having been wiped off, except the jointure of the Earl's widow, which ceases on her death.

Thus we see the inevitable tendency of the system of settlement is constantly towards deterioration in the pecuniary circumstances of each successive owner, or rather *nominal owner*, for such, after two or three generations, the apparent possessor of a settled estate usually becomes. Charges and mortgage debts accumulate on the estate, because instead of the natural and rational mode of providing for a family by dividing the estate amongst its members, the plan adopted is to keep the estate entire in the hands of one member of the family, and to provide for all the rest by annual or lump sums charged upon the estate. Such settlements are not confined to the large estates of England. Moderate properties are equally subjected to settlements. Indeed, there are comparatively few estates exceeding £1000 per annum, which are held for more than one generation without being made the subject of a settlement, so nearly universal is the practice. So tainted by the feudalism, upon which the notions begetting settlements are founded, is everything belonging to our land laws, and the customary methods of dealing with landed property in England.

On the *policy* of strict settlements, such as I have described, I will quote a passage from an opinion given by counsel on behalf of a gentleman of considerable landed estate which had never been the subject of a strict settlement, and who, being about to marry, was asked by the lady's friends to make a strict settlement on the issue male of the marriage, to which on his part objection was very sensibly made. This opinion is given by Mr. Hayes under a note headed, "Strict Settlements—Settlements by the Court of Chancery on its Wards—Primogeniture."

> The policy of such settlements is extremely questionable. It is difficult to refer them to any rational principle. The present possessor has the absolute dominion; his character is known, his right unquestionable. He is asked to reduce himself to a mere tenant for life in favour of an unborn son, of whose character nothing can be predicated, and who, if he can be said to have any right, cannot possibly have a preferable right. At no very distant period, the absolute dominion must be confided to somebody, and why should confidence be reposed in the unborn child rather than the living parent? Such a settlement has no tendency to protect or benefit the father, whose advantage and comfort ought first to be consulted. It does not shield him from the consequences of his own imprudence. On the contrary, if his expenditure should in any instance exceed his income, he, as a mere tenant for life, is in danger of being obliged to borrow upon annuity, a process which, once begun, proceeds generally, and, indeed, almost necessarily, to the complete exhaustion of his life income. But it may be urged that the settlement preserves the inheritance for the son, or—his committee or creditors. The son may be an idiot or a spendthrift. He may be tempted to raise money by *post obit* in his father's lifetime. If to these not improbable results we add all the family feuds generated between the tenant for life and remainder man, in regard to the enjoyment and management by the former of that estate which was once his own, particularly with reference to the cutting of timber, the disadvantages of thus fettering the dominion will appear greatly to preponderate. At best such a settlement is a speculation, at worst it is the occasion of distress, profligacy, and domestic discord, ending not unfrequently, as the Chancery reports bear witness, in obstinate litigation, ruinous alike to the peace and to the property of the family. Sometimes the father effects an arrangement with the eldest son on his coming of age; the son stipulating for an immediate provision in

the shape of an annuity, the father for a gross sum to satisfy his creditors, or to portion his younger children, and for a re-settlement of the estate. The arrangement, perhaps, is brought about by means, or imposes terms, which in the eye of equity render it a fraud upon the son, and here we have another source of litigation.

It occasionally happens, that by means of such settlements, estates are kept entire, and should the family not prove very prolific, and the successive possessors of the property prudent, very enormous fortunes fall to the lot of individuals. Sometimes also, where there are several settled estates belonging to different, perhaps distant, branches of the same family, and limitations are made throughout all the family connexions, we find, on the failure of some branches, several estates centre in one branch of the family, and a stupendously wealthy proprietor is created. But the more usual and common result of settlements is to produce encumbered and comparatively poor landed proprietors.

The very wealthy proprietors are apt to disregard the improvement of their property, to become excessive preservers of game, and to prefer a dependent and subservient tenantry to tenants of capital and independence, because their incomes are so large that they can afford to trifle with their property, and to be content with low rents, which are perhaps irregularly paid. Such proprietors are also often disposed rather to extend the area of their estates than to improve the territory they already possess. They like to see no competitors with them for county influence, and they buy up every property in their own districts they can lay hands on.

The more numerous classes of proprietors who hold settled estates, and whose real wealth is far less than the extent of the property nominally theirs would indicate, are unable or unwilling to expend money on the improvement of their estates for various reasons. They seldom make any savings from income, at all events not until late in life; and when they do save, their object is rather to increase the fortunes of their younger children than to increase by improvement the lion's share of the family property, which, under settlements, *must* go to the eldest sons. Nor do they like borrowing money for improvement, as they find already the annual charges of their encumbrances to be most inconvenient and burdensome.

Let any concern, be it an estate, a farm, or a factory, be burdened with debt, and the spirit of improvement on the part of the landowner, the farmer, or the manufacturer, will, in ninety-nine cases out of the hundred, be crushed out of him. And thus it is that the prevailing system of settlement tends to produce and has produced a body of landed proprietors who cannot, or will not, make the outlays which are necessary to effect the permanent landlords' improvements on their estates, and thereby render their farms attractive and profitable to farmers of capital and enterprise.

In my next lecture I shall point out some of the palliatives and alleviations of the evils of settled estates, which are to be found in the frame and provisions of settlements, and in certain modern Acts of Parliament passed with a view to the improvement of entailed properties.

LECTURE II.

In my previous Lecture on the effect of the law of real property upon English agriculture, I have shown you how inevitably the system of strict settlements tends to produce a body of landed proprietors who have more apparent than real wealth, and who really are, having regard to their habits and position, unable to make the permanent outlays their estates require. This has been, and is, a serious impediment to the progress of English agriculture. But, although the general tendency of settlements is to create impoverished landed proprietors, and to disable or disincline the possessors of settled estates themselves to make outlays in improvement, a well-drawn modern settlement always contains powers which enable the landowners to grant leases, and so to bring their farms within the reach of improvement through the agency of capitalist tenants. These powers are often so narrow and restricted as to prevent the owner of a settled estate from granting such beneficial leases as would induce their tenants to undertake all the large and durable improvements which fall properly within the province of the owner. But where no very large improvements are required, the leases which tenants for life are empowered by their settlements to grant will usually answer the purpose of enabling their tenants to farm with freedom and security. This is no doubt an alleviation of the burdens occasioned by settlements, of which, however, from causes I touched on when dealing with leases, too few landowners are willing to avail themselves.

The power to lease contained in the settlement of the Earl of A., to which I referred this morning, is as follows:—

> Provided also, and it is truly declared and agreed, that it shall be lawful for the said Earl during his life, and after his decease for the said B., C., D., etc. (his brothers and cousins), during their respective natural lives, as, and when, by virtue of the limitations hereinbefore contained, they shall respectively be in the actual possession, or entitled to the rents and profits of the said manors and estates, and also to and for the said (trustees to preserve), and the survivor of them, from time to time, and at all times, during the minority or respective minorities of any child or children of the said Earl, or B., C., D., etc. (brothers, etc.), who for the time being shall be so in possession of or so entitled as aforesaid by any deed or deeds, instrument or instruments in writing, to be sealed and delivered by him or them respectively, in the presence of two or more credible witnesses, and either referring or not referring to this present power, to limit or appoint by way of demise or lease all or any part or parts of the said manors and estates to any person or persons for any term or number of years not exceeding twenty-one years, to take *effect in possession and not in remainder or by way of future interest*, so that there be reserved upon every such lease, payable during the estate thereby created, *the best or most improved yearly rent or rents*, to be incident to the immediate reversion of the heredits so to be limited by way of lease that can or may be reasonably had or gotten for the same, without taking any fine, premium, or foregift for the making thereof, and so there be therein respectively contained a clause in the nature of a condition of re-entry on non-payment of the rent or rents thereby to be respectively reserved, and so that the person or persons named therein as lessee or lessees do execute a counterpart or counterparts thereof respectively, and do thereby covenant for the due payment of the rent or rents thereby to be reserved, and be not by any clause or words therein to be contained made dispunishable for waste, or exempted from punishment for committing waste.

Now here there is nothing to prevent the owner of the settled estate from granting the fairest and most liberal lease a capitalist farmer could desire, provided he was not required to sink any large amount of capital in doing landlords' permanent improvements, because, as you will have noticed, one of the conditions required by the power is, that "the best and most improved yearly rent" must be reserved. This would preclude the grant of a lease at a low rent, upon the terms of the tenant making large outlays in the permanent improvement of the estate. And it is important to tenant farmers to whom leases are granted under these leasing powers, that the conditions imposed by the power should be strictly adhered to, as otherwise the lease, though valid against the tenant for life who granted it, would not bind his successor under the limitations of the settlement. Another point of some importance when a lease is granted under such a power is, that such a lease is always required "to take effect in possession and not in remainder or by way of future interest," and the tenant must take care that on renewing his lease, if the old term has not run out, the old lease be surrendered.

I will make the effect of this clear by an actual occurrence. A friend of mine, one of the best farmers in Hertfordshire, has very greatly improved his farm by high-feeding sheep, by chalking and marling the land, and so forth, and his lease of twenty-one years, which was granted by a late proprietor under settlement, will expire in about three or four years. The present life-holder is a lady advanced in life, to whose grandson the property will devolve on her death. About a year ago my friend talked to me about his lease as we were riding over the farm together, and on the prudence of lowering his system of culture against the expiration of the term, as he was aware that some intention had been expressed of having the estate re-valued. I advised him at once to apply to the agent and treat for a renewal, so that he might either continue his high cultivation if terms of renewal were agreed on, or otherwise that he should slacken his sails and lessen his outlay in stock-feeding. This he did, and a willingness to renew the lease was expressed on the part of the landlady. But it was said the farm must be valued, and the new rent fixed with reference to present value. A valuation was made, and the rent proposed was 50 per cent., or one-half more than the present rent. My friend determined rather to give up the farm—he is a single man, and has land of his own—than give so large an advance of rent, produced entirely by his own improvements. However, after some negotiation, and a direct communication with the landlady, an increase of rent equal to about 25 per cent. on the present rent was agreed to on both sides. Then came the legal part of the business. My friend naturally does not wish immediately to surrender his old lease, and at once commence on the advanced rental, but, under the power enabling the landlady to grant leases, she can only grant a lease in possession, and a lease to commence three or four years hence would be "by way of future interest," and therefore invalid. Then, if the lease be at once surrendered, and a new lease granted, reserving the rent at the old rate for the first four years (the remnant of the old term), and then at the new rate, there might be some risk that the lease would not conform to the condition of the power which requires "the best or most improved yearly rent that can be *reasonably* had," and therefore on that ground open to question by the next successor under this settlement should he think fit to question it. Here, then, the improving farmer, and I may add the liberal landlady, are in a dilemma, from the horns of which it is not easy to escape. I think, however, if the power in the settlement in question contains the words "reasonably had" (which I do not know), a lease reserving the old rent for so long as the old term would have lasted, and afterwards the increased rent, would be held by our Courts to be "the best or most improved rent that could *be reasonably had.*" I have so advised my friend, and I dare say the new lease will be granted in this form. In this case the difficulty is of no practical importance, because my friend is on the best terms with the successor, a young nobleman of large possessions and liberal views. But you will understand that in some cases such a difficulty would prevent that most beneficial arrangement between landlord and tenant, the renewal of the tenant's lease three or four years before the expiration of the old one, because in most cases where the land has been well farmed, some advance of rent may be taken to be a natural part of the arrangement. I think some provision for cases of this sort ought to be introduced into strict settlements, for in the present state of husbandry, when leases again come into use, as I have no doubt they will ere long, the difficulty I have stated will be one of constant recurrence.

In some of the older settlements the power to grant leases was restricted to grants in the form, and containing all the stipulations which had been usually adopted on the estate, or in the locality. This power, which obviously prevented the grant by a settled estate owner of any lease which should be an improvement on the old lease, has been generally abandoned, and some such form as I have read to you is generally used by competent conveyancers.

There is another power often of some practical importance, namely, a power to sell or exchange the property, or any portion of it, which is always inserted in such settlements; but the various interests and encumbrances which affect such estates generally prevent the exercise of these powers, except for some purpose of great emergency or importance.

The next alleviation of the burdens of settlement was the grant by Government (under Sir Robert Peel, I think, in 1842, when the income-tax was imposed) of several millions to be applied as loans in draining settled estates, each loan to be repaid by a rent-charge, which would repay principal and interest in twenty-one years. This rent-charge was by Statute rendered the first charge on the estate, taking precedence of all other charges and mortgages. The loans were granted under the supervision of the Enclosure Commissioners, who sent inspectors to ascertain whether the improvement to be effected by the loan would comply with the conditions imposed by the Statute, and after the work had been done, to certify that it had been properly executed. Advertisements giving notice of the application for the drainage loan, which comprised all particulars of the ownership and locality of the property to be drained, so that any person having an interest in the property might offer his objections. Such objections were, however, seldom made, and a very considerable extent of land throughout England (and still more in Scotland), has been drained by means of Government loans. This Act, or rather several Acts, are still in force, and the money, as it is paid in as rent-charges, is, I believe, again lent out, so that it is still open to the owners of settled estates to avail themselves of Government drainage loans.

Though the Government Money Drainage Act was undoubtedly in the first instance a sop to the landowners on the imposition of the income-tax, the principle of allowing the owners of settled estates to improve their properties by means of loans to be first charges, and paid off by annual instalments, has been found so useful that considerable extension has been given to it.

In 1845 an Act (8 and 9 Vict. c. 56) was passed which enabled such landowners to apply by a short and summary petition to the Court of Chancery for leave to make permanent improvement in their lands "by draining the same with tiles, stones, or other durable materials, or by warping, irrigation, or embankment in a permanent manner, or by erecting thereon any buildings of a permanent kind, incidental or consequential on such draining, warping, irrigation, or embanking, and immediately connected therewith," and to pray that the expense of making such improvements might be a charge on the inheritance of the land. After an inquiry and certificate that the proposed improvements were proper, the money borrowed for the purpose, with all expenses, were indorsed on the certificate, which became the lender's security. Such charges were to take priority over all other charges, except the tithe rent-charge and any quit-rents. The money was to be repaid by annual instalments, varying according to the nature of the improvement, from twelve to twenty-five years; and the tenant for life in possession was bound to pay the interest and instalments, which should become due during the continuance of his interest in the land.

There have been various other Acts passed for these purposes, which vary only in details, and I will only notice a few of the more important of them.

By the 12th and 13th Vict. c. 100, "An Act to Promote the Advance of Private Money for the Drainage of Lands in Great Britain and Ireland," gave the Enclosure Commissioners power to make charges on settled land for similar improvements to those for which application by the Act I have before mentioned was to be made to the Court of Chancery. The Commissioners adopted the same plan of sending their inspectors to inspect and approve the improvements before they granted their certificate, which operated as a first mortgage on the property. The Commissioners might grant rent-charges for twenty-two years to the owner of the land, and might apportion the rent-charge so as to allot a definite portion as the charge on each farm. The landowners had by this time found out that, as regards draining at all events, most of their tenants on undrained farms would readily pay the drainage rent-charge applicable to their own farms, and hence the power of apportionment given by this Act to the Enclosure Commissioners.

About the same time there were two, if not more, Joint-Stock Companies, *i.e.*, "The General Land Drainage Company," and "The West of England Land Drainage Company," incorporated by Acts of Parliament, which obtained powers to make advances to landowners for draining, warping, irrigating, and embanking, and obtain rent-charges from the Enclosure Commissioners as in the Act of 1849. These companies also executed the works under the direction of their competent engineer and his trained staff, and they have since their establishment done a great deal of draining throughout the country in a very complete manner. Mr. Bailey Denton is, I believe, the engineer and surveyor of the General Land Draining Company. There are also several private agricultural engineers who have largely promoted and superintended drainage operations, amongst whom I may mention Mr. Josiah Parkes and Mr. Hewitt Davis.

Next in order of date was the "Lands Improvement Company," whose first Act I drew, and I supported it as counsel before a committee of the House of Lords. The Act was passed in August 1853. The promoters of this Company, of whom Mr. Hewitt Davis was one, contemplated a far greater range of improvement through the agency of the Company than had been previously attempted. The improvements which might be made under the provisions of the Act were—(1.) The drainage of any lands by any means approved by the Enclosure Commissioners; (2.) Irrigation and warping land; (3.) Embanking land from the sea or tidal waters, or rivers, in a permanent manner; (4.) Enclosing land, or improving drains, streams, or water-courses; (5.) Reclamation of land lying waste; (6.) Making farm-roads to the extent of one-half of the outlay for such roads; (7.) Clearing lands; (8.) Erection of farm-houses and other buildings required for farm purposes, to the extent of three-fourths of the outlay for such farm-houses and other buildings; (9.) Planting for shelter to the extent of one-half of the outlay for such planting. In effecting the improvements authorized by this Act, it is lawful to erect any engines, machinery, engine-houses, mills, kilns, sheds, yards, shafts, tanks, and reservoirs, pipes, conduits, and water-courses for irrigation, tramroads, and other ways, bridges, weirs, sluices, flood-gates, and hatches.

The powers of the Company are still very extensive, though somewhat limited by the committee on the promoters' plan. I believe one or more additional Acts have since been obtained by "The Lands Improvement Company," under which they are now authorized to charge all the cost of all the works on settled estates, instead of portions only, as I have stated from the first Act. Their powers are also extended, I believe, to some additional objects of improvement. These works are, as usual, to be executed under the inspection and authority of the Enclosure Commissioners. The Company has also power to purchase lands and to improve and re-sell, being limited to 500 acres held at any one time. This power, I believe, is not acted on. The rent-charges are to extend over periods, to be fixed by the Enclosure Commissioners, not exceeding twenty-five years. This has been subsequently extended; the obvious advantage of extending the period being to render the annual payment less, and therefore the improvement less burdensome to the actual possessor of the estate. Since, as we have seen, most of the owners of settled estates are subject to heavy encumbrances, it becomes of importance to them to render these improvement rent-charges as easy as possible. It was contemplated, and powers were given to the "Lands Improvement Company" to issue debentures, founded on and secured by certain rent-charges granted to the Company, which were to be appropriated for the purpose, and pass by assignment. The promoters had proposed that they should pass from hand to hand like Exchequer bills, but the Lords' committee objected, and the assignment plan was substituted. I believe, as altered, the plan has never been acted on.

This Company also had power, and, I believe, originally intended, to execute the works on behalf of the landowners, but in practice it has become merely the advancer of the money, and the recipient of rent-charges, the landowners themselves, under competent engineers, doing the work. In this form the Company has proved a great success, and has made good dividends. It is, in fact, a landowners' financial society.

The last Statutes I shall mention are two:—"To facilitate Leases and Sales of settled Estates" (19 and 20 Vict. c. 120), 1856; and an Act to amend and extend it (21 and 22 Vict. c. 77), 1858.

The first Act empowers the Court of Chancery, "if it shall deem it proper and consistent, with a due regard for the interest of all parties entitled under the settlement," to authorize leases of any settled estates for various purposes and terms, amongst others, for an agricultural lease of twenty-one years. The best rent that can be reasonably got is to be reserved, without taking any fine; it is not to authorize the felling of trees, except for clearing ground for buildings, and must contain a condition of re-entry. In short, the provisions are very much like the power of leasing which I read to you from a private settlement. The great use of this Act, as regards agricultural leases, is that the Court, being invested with considerable discretion as to the conditions on which leases of settled estates may be granted, can better adapt the lease to the special circumstances of each property and place, than can usually be done under a mere private power. There is also power to authorize a preliminary contract for a lease, which, where large works are to be executed prior to the lease taking effect, may be of much use. The Court may also authorize the sale of settled estates, or the timber on settled estates. And the produce of such sales may be applied to any of the following purposes:—1. Purchase or redemption of the land-tax, *or the discharge or redemption of any encumbrance affecting the estate;* or affecting any other property subject to the same uses or trusts; or, 2. The purchase of other lands, to be settled in the same manner as the property sold was settled; or, 3. The payment to any person becoming absolutely entitled. Special notices and advertisements are to be given of applications for sales under the Act, which may be opposed by any of the persons entitled under the settlement.

Then there is a general enabling clause (§ 32), authorizing any person entitled to possession or receipt of the rents of any settled estates for life, or for a term of years determinable with his life, or for any greater estate, either in his own right of his wife (unless expressly forbidden so to do by the settlement), to grant leases of any part of the settled estate, except the principal mansion-house and the demesnes thereof, to take effect in possession for twenty-one years, receiving the best rent that can be reasonably obtained, and without taking any fine, and the other stipulations usual in leasing powers, such as I have before stated. Such leases are to be valid against all the succeeding takers under the settlement, or where the husband grants the lease in respect of his wife's estate, against all persons claiming under the wife. The amending Act of 1858 merely gives extensions and facilities to the exercise of the powers conferred by the original Act. Here we see that, in the actual state of the law, the owner in possession of a settled estate may, in a great degree, relieve himself and his tenants and family from the evils which settlements have confessedly tended to produce on all of them. He can drain and otherwise improve the estate by means of loans, repayable by instalments extending over twenty years and upwards. He may grant leases for twenty-one years of the most liberal and business-like character, and adapted to promote the most approved and improving husbandry. He may procure any part of the estate to be sold for the purpose of paying off encumbrances; and, in fact, by the exercise of a little business tact and intelligence, he may place himself in a position little inferior to that of an absolute owner, with this exception, that he cannot alter the destination of the estate; so that if his first son be a lunatic or a spendthrift, and his second a man of probity and intelligence, he cannot (what in the absence of a settlement he would naturally desire to do) give the estate to the more worthy son, and provide a moderate and proper maintenance only for the elder and unworthy one. But, so far as it affects his agricultural tenant, a proprietor of a settled estate may do very much, if not all that a fee-simple owner could do, to promote improvement, and thereby to advance his own and his tenants' prosperity.

And it is really wonderful that landowners do not more readily avail themselves of the facilities offered by modern legislation for placing their properties in a more satisfactory position—a neglect only to be accounted for by their want of business habits or knowledge, or by the absurd vanity of being thought greater men than they are, by holding in apparent ownership a large estate, of which scarcely one-half can be truly considered their own.

There can be no greater mistake, whether on the part of a landowner or a farmer, than to seek to occupy a position apparently greater than his real one. Of the farmer's position when occupying a farm too large for his capital, I have spoken in a former lecture, and the position of the landowner, who has a beneficial interest in only one-third or one-half of his nominal income, is, if possible, worse than that of the farmer, whose farm is his master, instead of his being master of his farm; because the landowner occupies a station which, according to the usages of society, compels him to act up to his apparent position. Now, if a landlord, one-half of whose rental is applied in payment of interest upon the encumbrances on his property, would procure so much of the estate to be sold as would pay off all the encumbrances,—and this with some care and judgment would generally be accomplished by the sale of far less than one-half of the estate,—he would find himself a richer and really a greater man, both as to local influence and social position, than before. He would be relieved from the expenses of management of that part of the estate which was not his own. His stewards, his surveyors, and his lawyer's salaries and charges would be less than before he had cleared off the charges on his estate. He would be free from the constant expense of paying off mortgage money called in, and borrowing it from new lenders, to which every owner of an encumbered estate is liable, and which often amounts to a very serious burden on a large estate.

He would find himself able to build new cottages on the estate, and improve the old ones, without caring very much whether he got two or ten per cent. for the money so expended, and with the satisfaction of knowing that he and his tenants had gained fifty per cent. in the moral and physical improvement of the working people on his property. He might freely and handsomely subscribe to schools, to libraries, to church and chapel building, to the foxhounds, or to his Liberal or Conservative county club, without a thought of inconvenience, and with immense gain to his social standing, personal enjoyment, and general usefulness.

I cannot leave this subject without reference to the law of primogeniture which prevails throughout England, with the single exception of the county of Kent. By that law, if the owner of landed property—that is, the fee-simple owner—dies without having made any disposition of it, by settlement in his lifetime, or by will, the estate descends to his eldest son, if he has several sons, to the exclusion of all his other children, and to his only son to the exclusion of his daughters. Or in case he shall have no son, then his estate will descend to all his daughters, as coheiresses in coparcenary, *i.e.*, equally. So if his eldest son should happen to die before his father, leaving a child, whether son or daughter, perhaps an infant just born, that child would take, as heir of the eldest son, to the exclusion of all the other sons and daughters of the intestate proprietor. The intention of this law, which is wholly of feudal origin, was to give the estate entire to the eldest branch of the family, and the law of primogeniture forms the root and origin of that system of strict settlements which I described this morning in my former lecture. And such was the favour shown by the law to the heir—and, indeed, to any taker of the landed property under a will—that, as the law stood until very recently, if the landed estate which thus descended to the eldest son, or eldest branch of the family, or was given by will, happened to be burdened with a mortgage debt, that debt must have been paid off out of the personal estate of the intestate proprietor, which by law belonged to all of his children. For example, suppose a man possessed of a landed estate worth say £30,000, charged with a mortgage debt of say £5000, and possessed also of personal property, such as farming stock, money lent on mortgage, in the funds, railway shares, and the like, of the aggregate value of say £10,000, to die without having made any will, leaving several sons and several daughters, his eldest son would succeed to all the landed estate, worth £30,000, while the £10,000 of personal estate only would be divided amongst all his children, including the eldest son. This is not altogether even-handed justice. But that is not all. Until recently the eldest son might have required the mortgage debt of £5000 charged on the landed estate, which had descended to him, to be paid off out of the personal estate of £10,000. Thus, if the family consisted of five persons, the eldest son would take the land worth £30,000, cleared of the £5000 mortgage at the expense of the £10,000 worth of personal estate, leaving only £5000 to be divided between himself and his four brothers and sisters, or just £1000 a piece for the younger children, whilst the eldest son succeeded in land and personality together to £31,000. We have a maxim in the Court of Chancery that "equality is equity," but this is neither equality nor equity!

It is quite true that comparatively few landed estates of any great extent, in practice, descend or pass through the intestacy of the owner, for either by settlements or by wills the land is generally disposed of without coming within the operation of the law of primogeniture. But that law has established the principle, and has founded the usages and habits on which our owners of real property and the practice of strict settlements are founded. It stands in contradiction and distinction to the equal division of all property, which is the natural and most useful plan of succession, and which also was the old Saxon law of this country. For, in Kent, where the law of primogeniture does not prevail, but under the law of gavelkind, land undisposed of descends to all the sons equally, it is because the original and equal Saxon law of the land was preserved by the sturdy Kentish men against the power of their Norman Conqueror.

And this equality every political economist and jurist, who has not been affected by habit or prejudice to favour the existing state of the law, would desire to see re-established. Under a law of equal division—not, however, interfering with the power of any man to divide his property unequally, if he think fit so to do—in case of intestacy, accompanied by the practice of dividing landed property under settlements amongst the children in some proportion or other, instead of giving the estate to the eldest son, and charges on it to the rest of the family, we should find landed property more divided, and possessed by persons of more moderate pretensions, but with more real ownership than at present. We should have, perhaps, in the place of one landed magnate with an apparent income of £40,000 a year,—but too much hampered with charges and encumbrances to lay out much money in the improvement of the estates nominally his,—eight or ten proprietors with estates really their own, and rentals varying from £2000 to £5000 per annum, and who would have the motive and the power to improve themselves, and to aid in and encourage improvements by their tenants. To such beneficial ends two simple but important alterations in law would conduce; namely, (1.) to make landed property not disposed of by will divisible equally amongst all the children or next of kin of the intestate proprietor, in the same manner as personal property is now by law divisible; and (2.) to restore the original simplicity of our real property law, by enacting that where land is limited to a person for life, with remainder (*i.e.*, after his death) to his then unborn son, child, or children, the father shall be held to take an immediate estate in tail in the same manner as if the limitation had been made to the father for life, with remainder to the heirs of his body. In short, to bring the modern limitations to unborn children within the principle of the rule in Shelly's case. The father would then have the absolute power of disposition over the estate. Of course such power of disposition would be subject to any interests created in favour of any living person, such as a wife, child, or any *existing* person. But the varied "limitations over" of our present settlements would become impossible. These changes, I believe, would be socially and politically most beneficial, but it is chiefly in the interest of agriculture, and from an earnest wish for the advancement of English husbandry, and the elevation alike in social status and material prosperity of English farmers, that I would most especially recommend the adoption of those changes in our law of real property.

WHEAT EXPERIMENTS

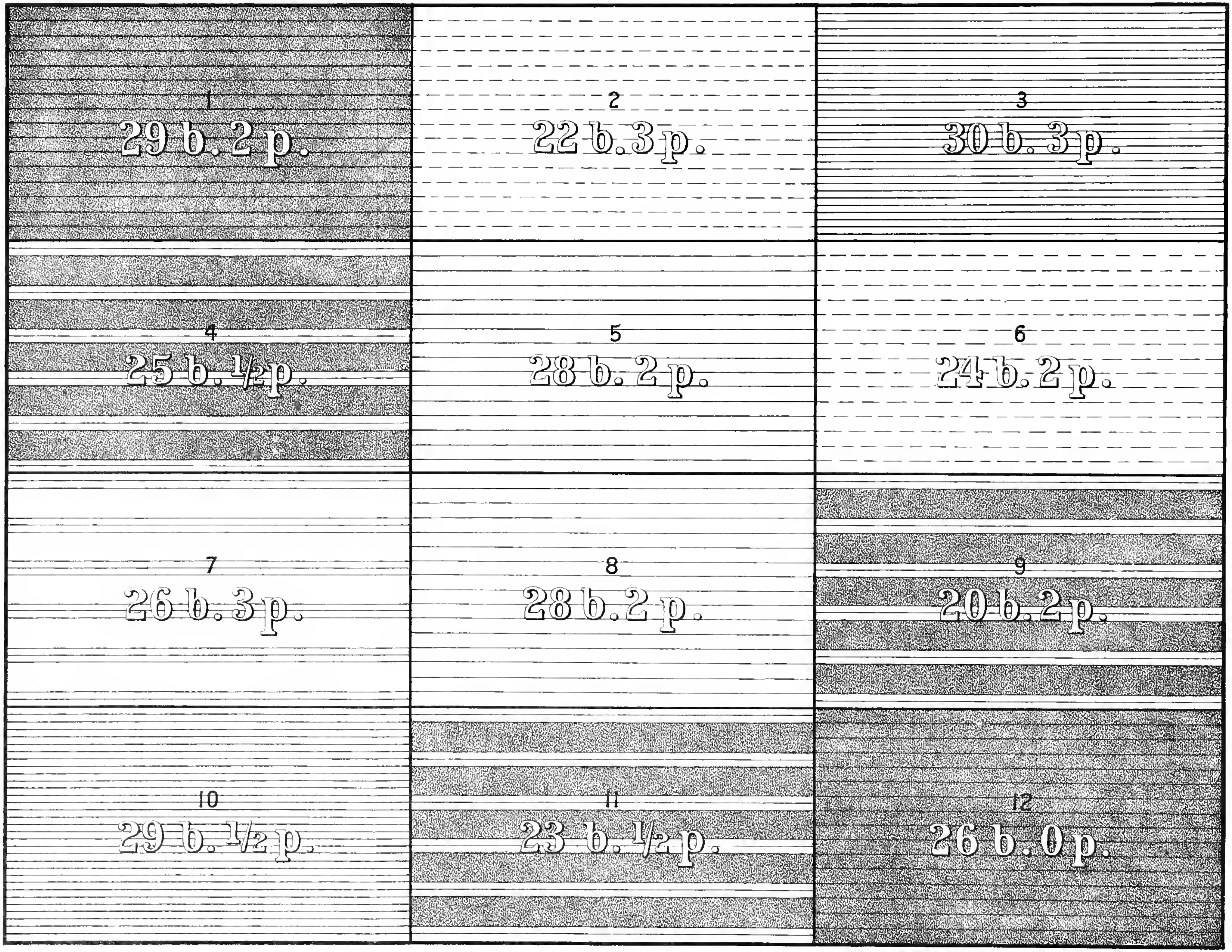
1868.

BY

JOHN WRIGHTSON, F.C.S., M.R.A.C.,

PROFESSOR OF AGRICULTURE IN THE ROYAL AGRICULTURAL COLLEGE.

PLAN OF WHEAT PLOTS.



WHEAT EXPERIMENTS

1868.

SOME experiments were instituted in 1865 in order to test the merits of the plan for growing wheat practised by the Rev. Mr. Smith of Lois-Weedon, and ably discussed in the *Journal* of the Royal Agricultural Society for 1865 by Mr. John Algernon Clarke. Many years would be necessary to enable any one to come to a conclusion as to the power of a particular soil to yield consecutive and remunerative crops of wheat. One or two seasons might, however, do much to show how far wide spaces between the rows and interculture affect the growth of the plant and the yield of grain.

The first series of experiments above alluded to has been followed by a second during the past season, and the results obtained seem to warrant further trial. The treatment of the plots, both in 1865 and 1868, was identical; I shall therefore, in the first place, state the method pursued, and after briefly glancing at the results of the first-named year, proceed to those obtained more recently. The object in both seasons was first to compare the merits of the ordinary mode of sowing, in which the coulters of the drill are placed 8 or 9 inches apart, with one in which rows are alternated with interspaces of much greater width. This would test the assertion so frequently made, that wheat requires more room for its full development than it is generally allowed. In the next place, the advisability of interculture during the growth of the crop was subjected to trial by plots upon the above-named plan, varying in this one respect, that they were to be cultivated by forking during the spring and summer.

The experiments of 1865 upon wide drilling were not commenced until April 18th, a period too late to allow that increase in leaf and stem consequent upon the free admission of air and light. Another source of error was the want of a sufficient number of plots fairly to test the truth of the answer which one might yield. In looking over these experiments, the general result appears to have been, that, in spite of the lateness of the season, a yield from the plots in which half the wheat was removed in mid-April much exceeded half the yield of ordinary wheat, and this gave encouragement to repeat the trial, commencing at an earlier period of the crop's growth.

The results obtained in 1868 are certainly worth attention, when we remember the peculiarly droughty nature of the season—one in which the benefits of wide drilling and interculture would be in a great measure counterbalanced by the surface of the soil being still more exposed to the rays of a too powerful sun.

During the past season the experiment was slightly modified, a series of plots was formed, the particulars of which we subjoin, and which will be better understood by reference to the plan of the plots.

No. 1. A plot in which every alternate row was omitted, making the rows of wheat 18 inches apart, the interspace being twice forked.

No. 2. A plot in which the rows were 18 inches apart, and the wheat afterwards cut out by the hoe, leaving tufts or bunches, instead of an uninterrupted row.

No. 3. A plot of ordinary wheat.

No. 4. A plot where three rows of wheat 9 inches apart were alternated with interspaces equivalent to three rows omitted, the spaces being forked.

No. 5. A plot in which every alternate row was omitted, leaving the rows of wheat 18 inches apart, the interspace not being forked.

No. 6. Duplicate of 2.

No. 7. A plot in which three rows of wheat 9 inches apart were alternated with interspaces equivalent to three rows omitted, the interspaces not forked.

No. 8. Duplicate of 5.

No. 9. Duplicate of 4.

No. 10. Duplicate of 3.

No. 11. 2d Duplicate of 4.

No. 12. Duplicate of 1.

In commencing the above experimental plots, difficulties arising from the construction of the drill were overcome by sowing the wheat in the ordinary manner at the usual distance between the rows. The plots were measured as soon as the young wheat appeared above ground. By adopting this plan, the plots could be made to terminate laterally in the centre space between two rows; an equal number of rows could be included in the breadth of each plot, and a uniform plant could be selected for the experiment. The wheat used was Hallett's Pedigree, grown for two years on the College Farm. It was sown on November 5th, on land previously under "seeds." The experiment was commenced January 28th, by measuring 12 plots of $\frac{1}{40}$th acre each. The plots contained 32 drills, averaging 9·4 inches each in width, and the dimensions of the plots were 38 lks. × 65·8 lks. After settling the position of each plot, the rows which were not required were hoed out, thereby placing the wheat at the required distances apart. Nine of the plots were prepared within a day or two of the date above given, and three more (10, 11, and 12) were completed on February 26th. Proceeding in this manner was considered equivalent to wide drilling, the unnecessary plants being removed, as in the case of young turnips, before they could interfere with the growth of the remaining wheat. Reference to the accompanying Plan of the plots will show at a glance the position of each. The dotted or speckled plots are those which were forked during the summer.

The first forking was completed on March 15th, and the second on 16th of June. The unforked plots were hoed in order to keep the fallow spaces clear of weeds.

The next recorded observation as to the effect of the above described treatment was made April 29th as follows :—

Plots 1 and 12. Very vigorous and much darker in colour than the remainder of the field.

Plots 2 and 6. Good, but inferior in length and strength of straw to 1 and 12—promising well.

Plots 3 and 10. Rather losing colour. The same appearance as the remainder of the field.

Plots 4, 9, and 11. Better colour than the usual crop, but not so vigorous as 1 and 2.

Plots 5 and 8. Good colour, but not so vigorous as 1 and 2.

Plot 7. Not any very marked effect. Better colour than remainder of field.

After this period the drought began to affect the crops in this district, and to hasten harvest. The crop was cut on July 20th, the experimental plots being ready for the sickle much about the same time. Before cutting the plots 6 ears were selected, with strict impartiality, from each plot, and the number of grains in each was counted.

The result of this is embodied in the accompanying Table. The average produce in grains of wheat from 12 ears taken from the untouched plots of ordinary wheat, will be seen to have been 31. There is an evident improvement in the wider drilled wheat to the extent of 25 per cent.; the improvement is less marked where forking has been added to width between the rows, but the greatest yield per ear was obtained from the tufted rows, in which 12 ears gave on an average 50 grains each, or about 62 per cent. more than the untouched plots :—

PLOTS.	Ear 1.	Ear 2.	Ear 3.	Ear 4.	Ear 5.	Ear 6.	TOTAL.	Average No. of Grains in each Ear.
Ears from untouched plots,	24	26	29	34	36	30	179	30
Do. do.,	36	38	39	26	28	29	196	32
Alternate rows omitted; spaces unforked,	34	51	41	25	36	46	233	39
Do. do.,	40	38	26	35	36	41	216	36
Alternate rows omitted, and spaces forked,	26	44	45	35	37	26	213	35
Do. do.,	35	31	28	35	26	27	182	30
Alternate rows omitted, and the remaining rows left in tufts,	47	43	67	48	41	47	293	49
Do., do.,	56	40	54	65	40	48	303	50

The experimental plots were threshed on August 10th, when the following tabulated results were obtained. The weight of produce in head corn alone was taken, and the measure was calculated at the rate of 62 lbs. to the bushel :—

RESULT OF WHEAT EXPERIMENTS, 1868.

PLOTS.	Head Corn per Plot.	Bushels per Plot, calculated at 62 lbs.	Actual weight per Bushel.	Produce per Acre.
	lbs.			bushels.
1. Alternate rows obliterated—spaces forked, ...	46	·74	65	29·6
2. Alternate rows obliterated—remaining rows hoed or singled into tufts or bunches—(*see* Plan), .	35½	·57	62½	22·8
3. Ordinary wheat, ...	48	·77	64¾	30·8
4. Three rows left and three rows obliterated—spaces forked, . .	39	·63	64	25·2
5. Alternate rows obliterated—spaces *not* forked, ...	44	·71	64	28·4
6. Alternate rows obliterated—remaining rows "tufted," . . .	38	·61	64	24·4
7. As in 2.—Three rows left and three obliterated—spaces not forked, ...	42	·67	64¾	26·8
8. Duplicate of 5, ...	44	·71	64¾	28·4
9. Duplicate of 4, ...	32	·51	65	20·4
10. Ordinary wheat, . . .	45½	·73	65½	29·2
11. 2d duplicate of 4, . .	36	·58	65	23·2
12. Duplicate of 1, ...	40½	·65	65	26·0

Quality of Grain.

In the last number of *Practice with Science,* Professor Church made some interesting remarks upon the amount of nitrogen found in different samples of wheat. On examining almost any kind of wheat, it was observed that the sample might be readily divided into three parts, the first containing all the horny or translucent grains; the second, those of a medium appearance; and lastly, a class of softer, opaque, dull-looking grains. Analysis of each section of a sample thus divided, showed that the amount of nitrogen contained in the translucent grains considerably exceeded that found in the opaque grains, and this was rendered the more striking when the nitrogen was calculated into its equivalent of albuminoids. We subjoin a Table taken from Professor Church's paper on this subject, illustrative of the above-named fact:—

Percentage of Albuminoids.

VARIETY OF WHEAT.	Translucent.	Opaque.
Spalding's, ...	11·19	8·75
Hallett's, ...	13·06	9·50
Archer's, ...	10·69	8·87
	Mean, 11·85	Mean, 9·04

In examining the various samples of wheat grown during the past season under the different cultivations before described a marked difference was observed in their apparent quality, so that although the whole of the plots were sown with one kind of wheat, the samples produced on the different plots might have been readily mistaken for several varieties. This difference was chiefly owing to the much larger proportion of nitrogenous or horny translucent grains in those plots which had been allowed a freer circulation of air. A simple analysis was made by taking three portions of 100 seeds from the produce of each plot, and counting the number of translucent, opaque, and medium grains in each portion. The accompanying Table will show the average of the three determinations in the case of all the plots subjected to this process:—

Percentage of Translucent, Medium, and Opaque Grain.

PLOTS.	Translucent.	Medium.	Opaque.
1. Every alternate row obliterated—species forked, ...	54	29	17
2. Every alternate row obliterated, and wheat hoed in row into tufts or bunches (*see* Plan),	82	14	4
3. Ordinary wheat for comparison, . .	32	20	48
6. Alternate rows removed, and remaining rows tufted as in 2, ...	79	17	4
4. Three rows obliterated and three rows left —forked, ...	61	25	14
5. Alternate rows obliterated—spaces not forked, ...	70	22	8
7. Three rows obliterated and three rows left —not forked, ...	73	17	10
9. Do. do. do., forked,	58	25	17

The most striking fact to be observed in examining the foregoing Table is the very much larger proportion of translucent grain in the widely-drilled than in the ordinary wheat. The "tufted" plots especially seem to indicate the much larger proportion of nitrogen that wheat under such cultivation is capable of absorbing from the air and soil than when under more ordinary conditions of growth. It may further be observed that *space,* and not the forking of the land, is the cause of this increase in the proportion of horny grains, the highest amount being found in the samples of wheat from 2, 5, 6, and 7, none of which were subjected to cultivation.

Condition of the Forked and Unforked Soil with reference to Moisture.

After the severity of the drought had made itself felt, it was thought that the amount of moisture retained by the forked soil might be compared with that held by the unforked land forming the wide interspaces in Plot 7. Accordingly, on the 9th July, two samples of soil were taken at a depth of 9 inches from one of the forked and wide-spaced plots, and two samples were also obtained from a wide-spaced but unforked plot. Mr. Grosjean, the chemical assistant at the College, kindly gave his help in securing uniform samples and obtaining correct results. The soils were placed in stoppered bottles and removed to the laboratory, where the water determinations were at once made. The amount of water in the four samples may be said to have been identical, as the following statement will show :—

	Per cent. of Moisture.
No. 1. Sample from forked plot, . . .	15·0
No. 2. " " " . . .	14·7
No. 3. " from unforked plot, . .	14·7
No. 4. " " " . . .	14·6

Conclusion.

The results arrived at by the above described experiment may be stated as follows :—

1. In no case was the crop so good as in the plots of wheat cultivated in the usual way.

2. Plots in which half the wheat rows were obliterated were so nearly equal to those of ordinary wheat, that when we remember that half the seed might have been saved by sowing at once with a wide-set drill, the advantage is pretty equal in both methods.

3. The forked wheat is generally worse than the corresponding unforked,—a result borne out by the experiments of 1865.

4. Since 25 and 26 bushels per acre were obtained from half the land under crop in the cases of Plots 4 and 7, the question as to whether the interspaces would not bear as large a crop the succeeding year, as at Lois-Weedon, is worthy of attention.

5. The quality of the grain produced under various conditions of growth is interesting. The weight per bushel does not vary much, but it is manifestly lower in Plots 2 and 6, where the wheat was not only widely spaced between the rows, but "bunched" or "tufted" in the row.

These experiments will, we hope, be again repeated during the coming season; and it is further proposed to utilize the wide interspaces by growing potatoes, carrots, or some crop which will not interfere with the development of the wheat plant.

EXPERIMENTS ON BARLEY

1868.

BY

JOHN WRIGHTSON, F.C.S., M.R.A.C.,

PROFESSOR OF AGRICULTURE IN THE ROYAL AGRICULTURAL COLLEGE.

EXPERIMENTS ON BARLEY

1868.

WHILE the foregoing wheat experiments were in progress, it was thought desirable to place a few plots of barley under similar conditions, in order to see how far the yield of this important cereal would be influenced by wide drilling and interculture. The barley to be subjected to this trial was sown on land upon which roots had been fed off with a liberal allowance of cake and hay by sheep. It was in fair, good tilth, but Plots 9 and 10 were rough, owing to the sheep having rested upon that portion of the field during wet weather, consequently never looked so well as the rest of the plots. The barley was sown on March 19th, the variety being Hallett's Pedigree, grown for two years previously on similar land on the College Experimental Farm. The plots were measured on April 29th, to $\frac{1}{40}$th acre each, the dimensions being 65·8 × 38 lks. The same plan was adopted in making the plots as in the wheat experiments, the alternate rows of barley being removed by means of the hand-hoe. By this method the requisite width between the rows was obtained. The following is a list of the plots :—

Plot 1. Untouched barley.

Plot 2. Alternate rows obliterated.

Plot 3. Untouched barley.

Plot 4. Manured with 13¼ lbs. (530 lbs. per acre) of superphosphate of lime.

Plot 5. Manured with 6¼ lbs. of nitrate of soda (250 lbs. per acre).

Plot 6. Duplicate of 2.

Plot 7. Alternate rows obliterated, spaces forked twice through summer.

Plot 8. Unmanured and untouched.

Plot 9. Duplicate of 4.

Plot 10. Duplicate of 5.

Plot 11. Excluded from the experiment.

Plot 12. Duplicate of 7 omitted.

It will be seen that two important manures were also introduced to compare with the untouched plots, and those subjected to interculture. The requisite operations of manuring and spacing were concluded May 4th.

It should be stated that, droughty as the past season was, in this neighbourhood we experienced no inconvenience until comparatively late in the spring. Early sown barley was consequently able to resist its effects, and, on the whole, continued vigorous up to harvest. The same conditions insured us a very fair cut of clover and rye grass.

The forked and widely-spaced plots soon exhibited a marked superiority in colour, length of straw, and breadth of foliage over the adjoining barley, and finally, swayed by its own weight, it leant over the wide interspaces, completely hiding them from view. The manures applied did not appear to exert a marked influence, but both plots and the adjoining ordinary crop continued promising.

The plots were cut in July with the sickle and bound into sheaves. The remainder was cut with the scythe and carried loose.

It now only remains for us to give the results obtained by threshing the plots on October 7th.

RESULT OF BARLEY EXPERIMENTS, 1868.

PLOTS.	Weight of Grain per Plot.	Weight of Grain per Acre.	Measure of Grain per Acre, calculated at 58 lbs. per Bushel.
	lbs.	lbs.	bush.
1. Nothing, ...	43·75	1750	30·2
2. Alternate rows obliterated,	55	2200	38·0
3. Nothing, ...	51·75	2060	35·5
4. Superphosphate, 13¼ lbs. = 530 lbs. per acre, . .	53·75	2150	37·0
5. Nitrate of soda, 6¼ = 250 lbs. per acre, ...	51·75	2060	35·5
6. Duplicate of 2, . . .	63·0	2520	43·4
7. Do., but forked, . .	59	2360	40·7
8. Nothing, ...	42	1680	29·0
9. Duplicate of 4, . . .	29·75	1190	20·5
10. Duplicate of 5, . . .	37·0	1480	25·5
11. Nothing (excluded), . .			
12. Duplicate of 7 (excluded), .	64·75	2590	44·6

TABLE II. *Showing the Average Result from Plots.*

PLOTS.	Average weight of Grain of similar Plots.	Average yield per Acre of similar Plots.	Average yield in Bushels, calculated at 58 lbs. per Bushel.
	lbs.	lbs.	bush.
1, 3, and 8. Nothing, . .	44·4	1776	30·6
2 and 6. Alternate rows obliterated, ...	59·0	2360	40·7
4 and 9. Superphosphate, at 13¼ lbs. = 530 lbs. per acre, .	41·75	1670	28·8
5 and 10. Nitrate of soda, 6¼ lbs. = 248 lbs. per acre, . .	44·4	1776	30·6
7 and 12. Do., but forked, .	62·0	2480	42·7

The results given in the foregoing tables are of a most satisfactory character, and the more so, on account of their general agreement. Thus Plots 2, 6, 7, and 12 may be looked upon as quadruplicates, so far as space is concerned, and they all point in one direction, namely, that there is advantage in wide drilling, which is apparently further increased by forking. One of the most striking features in this experiment is brought out by comparing it with the wheat plots, and such a comparison shows us that the attention which has been devoted to wheat interculture may perhaps be transferred to barley cultivation, with a still greater prospect of success.

With regard to the application of manures to barley, the experiment before us does not encourage it. Nitrate of soda, applied at the rate of more than 2 cwt. per acre, gave no better result than unmanured barley, and an application of superphosphate at the rate of 530 lbs. per acre was even inferior in its effects. The poor result obtained from superphosphate was, however, partially due to the failure of Plot 9, which was situated, as has been before mentioned, in a portion of the field where the land had been unduly trodden by sheep during wet weather.

CATTLE GRAZING:

ONE OF A COURSE OF LECTURES.

BY

JOHN ALGERNON CLARKE,

OF LONG SUTTON, LINCOLNSHIRE.

CATTLE GRAZING.

1. *Grazing of Breeding Stock.*—In a former lecture I named the best grass as most suitable for weaned calves and yearlings, —with night shelter if in the autumn. The two-year-old steers and heifers should be treated on a similar plan ; but while the yearlings should get the best bite, these maturer animals will be content with less quality in the herbage, provided you let them have plenty of it.

Thriving upon any pasturage that is in abundance, they may be looked upon as the purifiers and scavengers of the meadows, nipping off the rough grass and finishing up what the delicate, discerning, and dainty sheep may leave. It is well, however, to mow the rough tussocks in daily portions; for slovenly grazing is never so profitable as grazing with due regard to neatness, and keeping down bents, as well as thistles and nettles. Do not mistake me as representing that animals at this age may be properly put off with anything in the shape of a living; graziers sometimes injure the two-year-olds by parsimony; you should always keep animals doing well and improving ; and it is good management to save the animals from shrinking, particularly on the approach of winter—giving them a few early mangolds or early cabbage—sometimes a taste of oil-cake.

Suckling cows and heifers may be placed, a few in each field, along with other kinds of stock, store sheep and cattle ; when they generally thrive, the suckled calves appearing to be "amused," and benefited rather than not by the mixture. But, of course, it is a good general rule to keep males and females apart. It is a point worthy of note, that all suckling stock require *plenty of room* ; they are fond of roaming in search of stray blades of grass or other herbs, and the more thinly they are placed upon the pastures, the better they thrive as a rule. The intermingling of sheep and cattle is advisable for the even grazing, and the order and fruitfulness of the field.

The best land for suckling purposes is not the prime fattening grass, but what is generally known as second-rate sheep land, —that is, somewhat inferior in quality, not quite strong enough to fatten heavy sheep without artificial food. It is indispensable to have a supply of pure water. It is a material point that the suckling cow should yield her milk of an even or uniform quality, so that no damage shall arise to the calf; but bad water or bare pasturage will most likely induce scouring or feverishness, the cow's secretions will all go wrong, and the calf soon suffers. Change of pasture and good water are the grazier's remedies.

Your incalvers, cows, and heifers will be managed as store stock. As a rule, beware of having them too fat. In such a case, their produce will be generally a small and delicate calf, hard to raise, and slow of growth. "A well-grown calf is half raised." Of course I speak of ordinary farm management; the great breeders, bestowing any amount of money and attention upon tending and feeding their hundred-guinea dams, continue to breed calves from some extraordinarily fat animals ;

but depend upon it (for they often make sad slips, with all their appliances and expenses) breeding cows and heifers should be kept in a fair healthy condition, and nothing more.

As to *incalf milch cows*, you may milk a heifer (after her first calf) for five or six months, then let her grow and get substance before her second calf comes. A cow four years and more old, if well kept, may be milked within two months, nay even within six weeks of her next calving.

I may mention in this place, that, except when you have a brood cow of extra value (when she may calve seven or eight times, or as long as she will) a good practice is to "drape" your cows after the third calf,—they feed better and realize more than when drafted off to feed at a late age. And the young heifers that you have to spare can feed along with them. For you may calculate upon having about equal numbers of male and female calves; and there will be one-third of the heifers to spare every year.

I have spoken of breeding, and the grazing of your brood stock and young growing animals. But the general business of the grazier, who buys-in in spring, and sells out in autumn, must not be omitted.

2. *Summer grazing of Store and Fatting Cattle.*—In grazing *store cattle*, bear in mind that the previous treatment will be, so to speak, half the battle. Unless the animals are "well done" through the winter, you run a great risk in putting them on good pastures. If their constitutions have been impaired by hard living and bad treatment in wintering, the summer's grass will very probably not fatten, but destroy them. Being too weak to retain and appropriate the nutritive qualities of the grass they consume, they are liable to a laxative habit of body, and gradual decay and ultimate death ensue. In buying-in

stores, you cannot be too careful and cautious in your selection. "Foot-and-mouth" disease and "pleuro-pneumonia," when not fatal, are terribly enfeebling and detrimental, often reducing the victims to mere skeletons; and you cannot be too guarded in purchasing, lest you get hold of some poor partially-restored animals. But our fairs and markets abound with poverty-stricken and enfeebled stock; and when you are not tempted by ultra-cheapness to buy, you may very probably have specimens of your own breeding that you would not like to pass under the review of critical visitors as specimens of your herd. Well, to strengthen and prepare such weaklings for better grazing, one of the best resources is to preserve and provide for them a field of rough pasture, or a roughly eaten eddish, where they may be turned in early spring, and taken into the fold-yard every night, to be supplied with good dry food—straw, hay, and a ration of oil-cake or feed of meal. The animals thus gradually recover condition, and are then able to stand the stronger grass keeping. If you do not happen to possess such a field, then you had better put the animals upon the weakest portions first, having a moderate supply of cake and corn. As they improve, shift them from one class of pasture to a better, letting them rise by successive stages to more fattening grass. There is hazard and difficulty in grazing such a kind of stock; but some large graziers who have a gradation of all sorts of land sometimes make very handsome profits indeed, being able to buy animals that a smaller occupier of only medium or first-class grass dare not look at, and then trust to good judgment and watchful observation to push the animals along a gradually improving course, from leanness, hide, and bone, into really decent beef.

The first general point to be attended to in the summer grazing of cattle is to *adapt the kind of stock to the nature of* *the pasture.* The most powerful grass will of itself fatten an ox of one hundred stones weight without any artificial assistance; other meadows, even side by side, may have sweet and nutritive herbage, able to feed a small Scot or Devon; and commonly the power of second-rate land may be increased or supplemented by plentiful supplies of linseed-cake, or other fattening food. But while the experience of some graziers countenances the giving of oil-cake liberally to grass-feeding beasts, other very eminent and successful managers deny that it is profitable on very good land—they use only cotton-cake to "keep their bodies right." At any rate, it is very certain, that it is folly to attempt fattening big steers on pasture not well adapted by nature for the purpose. New tenants often injure themselves by not taking timely advice on this point from persons whose experience has made them familiar with the particular fields which may have been just entered upon.

The Lincolnshire occupiers of first-class bullock-land—and I do not believe there is any better to be found in the United Kingdom (I have seen some of the primest in county Meath in Ireland, and elsewhere)—are very proud of having immensely heavy bullocks, that you would think ready for the butcher when they are bought in, in spring; and there is no doubt that their experience is the best guide. Put very big, very fresh animals upon the primest land, and you will get more profit than by stocking such fields with inferior beasts. However, there are cases in which cattle in poor condition—as old cows, bull-sags, worked oxen, coarse raw-hided steers—have been put upon poorer bullock-land with good effect, when only such a superb quality of herbage could "move" such a class of animals. The risk is, that your poor, impoverished, ungainly stock may be weak in body or constitution, when the succulent forcing grass will be sure to send them wrong. Here comes in the rare judgment on the part of the grazier, in knowing from the previous history, as well as present apparent condition of the animals, whether or not he dare place them upon such high-pressure food.

The best bullock lands, like other pastures, require to be prepared for the spring by "laying in" early. Next, you must stock in suitable weather, and in number proportional to the state of the "keeping." In any case, do not overstock at first; by so doing you invariably forfeit all advantage from the whole season. The animals should have a sufficiency of grass: but then they should not have more; because, then, the grass will grow scarce and unpalatable, and when the field has abundance of grass to spare, the stock will confine themselves to those sweet spots on which they may delight to browse, often thus kept too bare and insufficient for their profitable advancement. Where portions of a field are unavoidably left by the stock to "run away," always mow down daily and gradually any rough spot, leaving enough for every day's consumption. Cattle are very fond of partially withered grass. On lands subject to burning in hot, dry weather, it is a question how great a length of herbage is advisable. In Herefordshire and Leicestershire, and many other places, I have seen pastures which, while carrying their usual quantity of stock, would, I think, yield at the same time a ton or more of hay per acre, the cattle positively up to their knees in grass. Such lands may require a protective covering, but this seems beyond the limits of economy. To fatten cattle most speedily and advantageously, the grass requires to be ever new, and always in plenty. Not *too* young—that would cause looseness or scouring—and not too old, but a good bite of strong grown grass, in accordance with the old adage, "twelve days old for a bullock." To insure this, some people attempt to graze two fields alternately; that is, they lay in one piece for three or four weeks, while the other is being fed off. But this plan is objectionable, because it involves a double number of stock at one time, thus treading down a great quantity of excellent herbage. The better course is to "get off" the most forward animals to market; lay in, say one field, well dress it over,—that is, knock the droppings, and cut up the tussocks on rough places, that all the grass may be young and fresh; and then turn the backward animals into this beautiful autumn pasture. The old-fashioned plan in Lincolnshire is to reserve the best eddish or aftermath for this purpose; and if this cannot be done, to hovel the animal at once for Christmas beef. This is very expensive, and seldom pays; if a beast, bought in for summer fattening, fails to keep his promise, I say get quit of him, and let somebody else feed him for the late autumn, if they please.

Fatting animals seldom require the services of the veterinary practitioner: the chief point being to change their keeping, if requisite, as in untoward seasons, or upon an extraordinary flush of grass, or similar sudden alteration from regular grazing, as in a season of drought. Water frequently fails, or becomes injurious in quality. Of course it is the master's business to save and make money whenever he can, by promoting the well-doing of each particular animal, by all sorts of contrivances, and changes of his stock from one place to another, and so on, as required. "It is the eye of the master that grazes the ox." The chief changes in keeping will be from very nutritious to old pasturage, from inferior and bad herbage and bad water, to an eddish, or to green clover or seeds; or if dry food is indispensable, providing an allowance of straw or hay.

Physicking a nearly fat beast is a very juvenile proceeding. If anything is the matter, and looks like something serious, the butcher's knife is better than the lancet, and should be at once resorted to.

I do not propose to enter minutely into estimates of expenses and returns in cattle grazing; but there are certain interesting conclusions with respect to the very variable produce in herbage upon meadows, which it may be well to mention among general "agricultural constants."

In a very valuable paper in volume xi. of the *R. A. S. E. Journal,* Mr. J. C. Morton estimates, from many cases and considerations, that 8 tons of grass (in grazing) may, by careful consumption, produce 9 stones imperial of beef; from experience, he knows that turnips, consumed with any artificial food, will not generally yield more than 1 lb. of beef or mutton for every 150 lbs. of green food; and, giving grass credit for a little more nourishment than this, he assumes that 140 lbs. of grass will yield 1 lb. of meat. The best grazing lands in Lincolnshire will, under the best circumstances, feed an ox and a sheep from New May-day till Old Michaelmas,—the beast will gain 20 stones, or 280 lbs., and the sheep 10 lbs. a quarter, or 40 lbs. in the time. The acre will then yield 320 lbs. of meat. Its produce of grass may be 16 tons, perhaps more. This is 1 lb. of meat for every cwt. (112 lbs.) of grass; but then the quality of that grass is far richer than the average run of grass, which is the subject of the foregoing estimate.

2. *Improved Summer Grazing.*—I have endeavoured to outline the general course of ordinary grazing. But old-fashioned practice is capable of improvement in many parts of the country.

It has lately been a growing complaint that there *is a difficulty* (and an increasing one, long before the Cattle-plague came) *in procuring good grazing animals* to start with.

Winter feeding now abstracts very largely from the supplies of the summer grazier; it causes the price of store stock to rise so high that *profitable grazing is not so likely a thing* as the prices of meat would lead us to expect. Breeding, combined with feeding, has for many years past been the most paying part of the business. When the late Lord Spencer endeavoured to persuade the farmers of Northamptonshire to turn their attention more to breeding their own cattle, he gave as a very cogent reason for their doing so, that his own home-bred steers paid him more per week from the time they were calved to the time they were sold as fat oxen than the cattle he bought for grazing did for the last six months they were feeding. *Therefore extend breeding when practicable.*

And one cause of this great demand for and consequent high price of store cattle is *the very imperfect manner in which too many of them are now fed.* We give a very high price for what may be termed the raw material, and then waste a large portion of it. It is a positive waste to send thousands of young beasts annually to be slaughtered that are barely in a half-fat state. This, however, is commonly done in the autumn of every year. These beasts are grazed at so early an age, that their common pasturage alone does little more than support their growth; they are consequently unfit for the fat-stock markets, and ought to be sent (if sold they must be) to the markets for store cattle. Thousands of such, having attained maturity, would make really good beasts if kept another year, and are worth much more to keep than to sell.

In a Farmer's Club paper, Mr. Owen Wallis, of Overstone, Northampton, quoted from a large cattle-salesman, of great experience in the metropolitan markets, who gives what, according to his judgment, would *be the increased weight of cattle sent to market* during the grass season, provided those sent were really and fairly in a fit state for slaughtering. They would, with only a little additional feeding, weigh, on an average, six imperial stones per head more than they now do; and as the average weight of beasts sent, from February to the end of March, is estimated at forty-six imperial stones, an increase of six stones would be fully one-eighth more.

The defect is to be remedied mainly by the *consumption of cake*, etc., *on pasture land*, that is, upon *ordinary grass*, not upon the *best* qualities, where it is a question whether cake is desirable.

Large fields must be divided, because *you cannot give cake or meal to a large number of beasts in a field; before the whole* could be given out the first portions would be eaten, and the master beasts would then disturb the weaker ones, and rob them of their fair share of the food. I should say, fifteen bullocks, certainly *not more* than twenty together.

The smaller the lots the better they will do; for a larger percentage per acre can be kept on moderately small than on large fields, owing to the grass grazing evenly on the former, while on the latter, some parts are eaten closely and other parts left to get coarse.

Cake is best given in small boxes set about the grass, giving a box to each beast. But some people simply throw the cake upon the ground, the bullocks sometimes nipping up coarse grass for the sake of the particles of cake which adhere to it.

But to carry out the system in an efficient manner *field hovels are necessary*, of a size suitable for accommodating the number of cattle each piece will graze. And here comes in the requirement of proper accommodation, to be provided by landowners.

Cattle often sink in hot weather in consequence of racing about the fields. If they were tied up *at such times,* and given cake, meal, or good hay or chaff, they would be making flesh.

Low sheds with roofs of slate (which people are most ready to put up, for they seem neat) *are the worst,—intensely hot.* Thatch the roof, or cover with thorn or gorse fagots, and fit up simply with good wide mangers.

As to whether cake, or barley, bean, or other meal is most suitable for this artificial supplementing of the natural food yielded by a pasture depends upon *the relative market values* of the different articles of diet at any particular time, and also upon the state of the grass; so that no precise and invariable rule can be laid down. When the grass is very succulent, straw or hay, chaff, and meal, are best. In *hot weather,* when the pastures are in a dry state, cake and hay.

Some graziers use the Egyptian bean meal very successfully, given with straw chaff cut very fine. By this plan, and consequent *improvement to the pasture,* Mr. Oakley of Laurence End, Herts, found that he could feed on the same land more than *double the number* of cattle that he did formerly, notwithstanding they were put in yards at night, and thus took some of the manure from the pasture.

Mr. Owen Wallis's plan was to begin with 4 lbs. cake per day, and finish with 6 lbs., average 5 lbs.,—this, continued for six weeks, will amount to 15 stones per head, not exceeding 20s. This cost will be amply repaid, if we can get £2 more for a beast; *which is not much difference between* a ripe bullock and one not well up to the mark.

But THE EXTRA NUMBER OF BEASTS FED ON THE SAME LAND gives a profit—the rent, rates, and taxes remaining the same, to say nothing of the *rapid improvement of the land.*

In following out this artificial system of feeding, *a grazier* *should time* his feeding according to another consideration, *i.e., the equalization of the supplies throughout the kingdom.* At the close of "the Norfolk season" there are but few grass-fed beasts ready for market, and beef is very scarce; whereas in October and November many more beasts are sent than there is a good demand for, and are sold badly. If a portion were got into a forward state during the winter, and kept improving by cake spread on pastures, they would be ready for market when wanted. As these are sent away, others take their places, and so on. By this arrangement no one lot of bullocks would be at expensive food so long as to cause too great an outlay upon them. This part of the feeding process should not exceed six, or at most eight weeks.

Do not adopt this plan with lean cattle, or upon very fine old pasture.

4. *Judging Cattle.*—Animals that fatten faster than others are *generally more handsomely formed,* and on handling them we find the skin and parts beneath soft and mellow. This "mellowness" is a kind of softness and elasticity perceived upon pressing the skin with the fingers, and is a favourable sign of the aptitude of animals to fatten. These parts are the cellular membranes, which in fat animals are full of fat; and, in store stock, the possession of this mellow feeling denotes that there are plenty of membranous cells ready for the reception of fat. It is absolutely necessary that a breeder should attain this knowledge—the power of being able to detect and appreciate the capacity of an animal for laying on flesh by means of the feel.

This peculiar soft supple feel of the skin, which is commonly called "handling well," is generally accompanied by hair of a soft, fine quality, and in great plenty.

The art of ascertaining by a few slight touches upon certain parts of a bullock whether it will lay on fat on the most valuable points, and in the most expeditious manner, can be acquired only by long practice and observation. I fancy that it is almost an instinctive faculty with some people, and requires at any rate a love of animals, without which there seems to exist in people no eye or hand for discerning "the points." The intuitive perception of the difference between one bullock's feeding properties and those of another is something that cannot be described in words or explained in rules so that anybody who hears the directions can at once put them into successful execution. Culley, a great authority on cattle matters, says, "I have often wished to convey in language that idea or sensation we acquire by 'touch' or feeling of our fingers, which enables us to form a judgment when handling an animal intended to be fattened. But I have as often found myself unequal to fulfil that wish. It is very easy to know where an animal is fattest that is already made fat, because we can evidently feel a substance or quantity of fat upon all those parts that are denominated 'the fattening points,' but the difficulty is to explain how we know or distinguish animals in a *lean state*—*which* will make fat, and *which* will not, or rather, *which* will make fat on such and such parts or points, and not on others. This a person of judgment (in practice) can tell, as it were, instantaneously. I say 'in practice,' because I believe that the best judges *out of practice* are not able to judge with precision; at least I am not. We say 'this beast touches nicely upon its hips, ribs,' etc., etc., because we find a pleasant mellow feeling upon these parts; but we do not say 'soft,' because there are some of this same sort of animals which have a soft, loose handle, of which we do not approve, because, though soft and loose, they have not that mellow feel above mentioned. The one will quickly make fat, the other will not."

I remember seeing Mr. Bowly handling a grand Bates cow of his. It was grazing knee deep in grass on his water-meadows at Siddington. He gently grasped a handful of the pliant skin with its velvety cushion of hair, as though he palpably enjoyed the peculiar yielding yet elastic feel in the hand.

Next, observe the *temper* of the animal. In selecting from a considerable drove, you will often find beasts possessing many of the good points, yet in lower condition than some of the animals of a worse appearance; consider well whether this may not arise from the masterful disposition of the ill-made one, and whether, when put up to fatten where any beast may eat his share of food without disturbance, the good-bred one will not soon surpass his more masterful neighbour. If you observe a beast that is constantly watching an opportunity to gore any other that comes in his way, leave him behind, even if he is much heavier than those you select; he may be a great trouble to you.

Never buy animals that are *excessively poor,*—they will consume a great deal of food before they are got into *health* enough to fatten.

It is an important matter to be able to *judge* a beast properly, not as a store, but as a fattening or fat animal. If an ox is all right *in point of health,* and *not over-driven to the market,* he should hold his head in a line level with his back; his hide should be smooth, well licked, and not staring; his eye clear; ears lively in movement, and he should have a dewy nose. Of course he is in a bad case if hanging the head, looking dull, and not standing well on his feet.

Viewed in profile, the *carcass of a well-fatted beast* should, as nearly as may be, approach to a rectangular form,—that is, from the setting on of the tail down to the hock should be a straight line perpendicular to the straight horizontal line of the back, and from the top of the shoulder down to the breast-end should be a similar perpendicular straight line; while from the breast-end to the hock should be another straight line parallel to the back. If length in this parallelogram be valuable, the great depth between the back and belly lines is also requisite for great weight of flesh. By imagining the carcass of a living beast to be enclosed within such an oblong frame, your eye will at once detect superfluities and deficiencies; you will perceive whether the flank is shrunk up, or the brisket dropped too much down; or if the back be hollow, or the shoulder or rump too high. And at the ends of the parallelogram, the chine may be wanting, or the thighs or rounds of beef insufficiently loaded. When you look at the animal behind, see how far he fills up a square, with great breadth between the hook-bones at top, and heavy rounds with a broad thick twist, as it is called, between them. And in front, the chine and shoulder should swell out, and the chest be expanded, so as to fill out the same rectangular figure. The ribs should be well sprung out; there should be meat enough before the shoulder to prevent any sinking-in of that part; and from the hook-bone to the rump there should be a gentle slope, without a hollow. Stephens, who gives these directions in his *Book of the Farm,* adds that, in handling, you may touch the rump and hook-bone, though, if these are well covered, the eye can perceive it. The chief points for the hand are the ribs, back, and flank. The skin should feel soft and pliant, and the flesh soft and thick, not hard and thinly covering the bone; but yet there should be firmness enough to prevent your shaking the flesh to and fro; and practice alone can detect the difference between a kindly and a loose "hand." You should feel if there is plenty of meat along the back and loin, where the best beef is deposited. If the flank be thick and the scrotum fat, you guess that the bullock will "die well," with an abundance of internal fat or tallow.

FARM ACCOUNTS.

BY

ARTHUR J. HILL, M.R.A.C.,

OF THE FIRM OF THEODORE JONES AND CO., ACCOUNTANTS, LONDON.

FARM ACCOUNTS.

It is a fact, the cause of which is not so self-evident as to require no explanation, that amongst farmers—even those who are considerably enlightened and given to progress—book-keeping is neither a favourite nor much followed pursuit. Three causes may be briefly alluded to, which influence various persons in various degrees, but which all conduce to the same indifference to the subject. In the *first* place, the mind of one engaged in a business that cannot with propriety be styled a lucrative one, is not readily impressed with the belief that any pecuniary profit can be derived from the devotion of time, labour or money to the correct keeping of accounts. *Secondly*, there is something in the nature of agriculture as an occupation which, if permitted, tends to produce an unbusiness-like state of thought; moreover, a certain lassitude of body caused by life in the open air leads a farmer to grudge his attention in the evening hour to a subject which many persons feel to be devoid of interest. *Thirdly*, the difficulties which undoubtedly exist in the way of devising a system of accounts to suit the requirements of a farm, so as to place their functions on a level with those of mercantile books, will often deter one who attempts for a time to master them from carrying out anything beyond the simplest statement of receipts and expenditure. It is these difficulties of which we propose to treat, and with which we shall endeavour to a certain extent to deal.

There are two principal objects which book-keeping has generally in view; the first is that of protecting a man against loss arising from error, carelessness or fraud; and the second is that of showing him what he is gaining or losing, either by his business as a whole, or by each several department or group of departments which it comprises. The former of these objects is by itself amply sufficient to make it every farmer's duty to keep even the simplest books in preference to none at all; and if the ability to discover the loss or gain on his business does not supply sufficient motive, we can suggest no other advantage that is likely to do so. But what would give the greatest satisfaction, and best repay even the additional toil, would be to use such means as would enable him to ascertain at the year's end, with as near approximation as the best agricultural experiments will allow, how much he has gained by his wheat crop, how much by his barley, his cattle, and so on.

The simplest form of accounts that can be recommended, showing only the profit or loss on the business *as a whole*, is as follows:—It comprises a cash-book, a bought day-book, a sales day-book, and a ledger. Either of the day-books may include the closing journal entries, so as to avoid a further multiplication of books. A granary and labour-book may be useful as records of work and memoranda between master and men, but they need form no principal part of a system of accounts, which has no higher aim than the result of the business as a whole.

The most simple form of cash-book is as follows:—

*

Dr. CASH ACCOUNT.

Date.	Folio of Ledger.		A. Discounts.			Ledger Accounts		
			£	s.	d.	£	s.	d.
1869.		Balance,				117	10	6
April 2.		To Trade A/c., ready money for Ram.				12	12	..
,, 5.		,, R. Elliott,	0	3	4	15	16	8
May 10		,, J. Sturge,	2	0	0	88	0	0
Aug. 18.		,, T. Webb,	2	1	8	112	10	4
Sep. 30.		Abatements,	4	5	0	346	9	6
		Balance,				77	19	0

April 1869. *Cr.*

Date.	Folio of Ledger.		A. Discounts.			Expenses			Ledger Accounts		
			£	s.	d.	£	s.	d.	£	s.	d.
1869. April 3.		By Trade A/c., bo't. & paid for corn-crusher.							8	10	0
,, ,,		,, T. Wallace,	0	10	0				42	10	0
,, ,,		Stamps, .				0	5	6			
,, 7.		Labour, .				7		0			
Sep. 30.		,, Do. to date,				210	0	0			
,, ,,		,, Trade A/c., for expenses.							217	10	6
		Balce. down,							77	10	0
,, ,,		Abatements,	0	10	0				346	9	6

* Centre of Book.

Explanation.—On the left-hand page is entered cash received, on the right-hand page cash paid. Immediately after the words "To" and "By" is placed conspicuously the name of the account to which the amount is to be posted. The discounts are shown in columns **A A.** R. Elliott owed £16, and £16 must be posted to his credit; but at the settlement of his account he was allowed 3s. 4d. abatement, which is a charge against the business, and is entered in the first money column on the debit side. Similarly, T. Wallace granted an abatement of 10s. on an account for £43 due to him, and this abatement is in favour of the business, and is entered in the first money column on the credit side. At the close of (say) six months, the total of the discounts on cash received is posted to the debit, and those on cash paid to the credit of the trade account, the former being in diminution, and the latter in augmentation of the profits.

In order to avoid frequent posting of small sums to the ledger, there is provided on the credit side of the cash-book a column for petty expenses and wages, which are totalized at convenient intervals and brought into the ledger accounts column, whence they are posted to the debit of trade account, being, of course, a charge against the business.

The method of opening and closing the cash account is indicated in the illustration.

The form of the day-books is as follows :—

1. *Bought Day-book.*

Old Oak Farm, *April* 1869.

			£ s. d.	£ s. d.
April 1.	*	T. Wallace, ...	†	43 0 0
		for Sheep, 13 @ 40/, . .	26 0 0	†
		,, Cows, 1 ,, £17, . .	17 0 0	

2. *Sales Day-book.*

Old Oak Farm, *April* 1869.

			£ s. d.	£ s. d.
April 2.	*	R. Elliott, ...	16 0 0	†
		for sundry Implements, .	†	16 0 0

* Column for folio of ledger.

† These columns in both books to be added up, and totals carried forward. If correct, the totals in each book will, of course, equal one another.

The amounts in the bought day-book are from time to time posted to the credit, and those in the sales day-book to the debit of the personal accounts in the ledger, and at the close of the year, when this is done and all the cash posted, supposing the total purchases to be £1500, and total sales £2400, the following entries are to be made in either of the day-books, as well as any similar ones that may be necessary :—

	£ s. d.	£ s. d.
Trade Account, ... *Dr.*	2000 0 0	
To sundry a/cs. for purchases, . . .		£1500 0 0
To Sir John Trimmer for rent, 1 year, .		500 0 0
Sundry a/cs., ... *Dr.*	2400 0 0	
To Trade A/c. for sales, ...		2400 0 0

and these amounts are to be posted respectively to the debit and the credit of Trade Account, and the rent to the credit of the landlord's account.

The Trade Account will thus take the following form :—

Dr. TRADE ACCOUNT. *Cr.*

		£	s.	d.			£	s.	d.
1869. Mar. 31.	To Stock at this date, . .	4010	0	0	1869. Apl. 2.	By Cash, ...	12	12	0
Apl. 3.	,, Cash, ...	8	10	0					
1870. Mar. 31.	,, Cash, expenses, . . . 1st half, £217 10 6 2d ,, 216 14 6	434	5	0	1870. Mar. 31.	,, Abatements, . . . 1st half, £0 10 0 2d ,, 8 10 3	9	0	3
					,,	,, Sundry sales, . .	2400	0	0
,,	,, Abatements, ... 1st half, £4 5 0 2d ,, 7 2 6	11	7	6	,,	,, Stock at this date, . carrd. down.	4532	0	3
,,	,, Sundry purchases, . .	1500	0	0					
,,	,, Sir J. T. for rent, . .	500	0	0					
,,	,, Balance, being profit, transfd. to capital a/c.,	489	10	0					
		6953	12	6			6953	12	6
,,	To Stock, ...	4532	0	3					

According to this plan, we shall only have the following accounts in the ledger :—

1. Capital Account, the balance of which will equal the

stock on hand, *plus* the cash and bank balances, *plus* the debts due to the business, *minus* the debts due from the business.

2. Trade Account; and,
3. Bank and Personal Accounts.

The form of the Balance Sheet will be the simplest possible, viz.:—

Dr. GENERAL BALANCE.—*March* 31, 1870. *Cr.*

*		£ s. d.	*		£ s. d.
√	To Sundry Creditors, for bal^{ces}. due to them.	......	√	By Sundry Debtors, . . for bal^{ces}. due by them.	......
1	,, Capital Account, . . for balance,	......	6	,, Cash Account, . . .	......
			8	,, Bank Account, . . . for balances.	......
			50	,, Stock on hand, . . .	......
	£	......		£	......

* Columns for Ledger folios.

This arrangement is a complete, though far from an elaborate system of Double Entry, or, speaking more strictly, of *Single Entry periodically converted into Double Entry;* and after all entries and postings have been made, and balances struck, the agreement of the two sides of the balance-sheet will afford the ordinary check against inaccuracies in the accounts.

It will be noticed that we have included sheep, cattle, implements, etc., in a single ledger account, called the Trade Account. The object in so doing has been to describe the least complicated form of books imaginable, which must be the foundation of any more intricate system, and serves therefore better to illustrate the principles of book-keeping than if we had at first treated of the subject in its higher form.

It seems, however, of comparatively little use to split up the

Trade Account into the different departments of which it is composed, unless the object in so doing is to discover by a somewhat full and complete process the gain or loss on each of those departments, and this can only be accomplished by charging against each its fair proportion of expenses. Unless this be done, the balance of the sheep account will be almost certain to show an inordinate profit, while that of green crops will indicate a heavy loss; whereas the most important function of the green crops has been to produce the mutton and wool, and the greater part therefore of the cost of the production of the roots should have been debited to sheep before the balance of the sheep account was struck and transferred to Trade account, the remainder being debited to the succeeding crop. It is as though, in a straw hat and bonnet manufactory, the straw employed were not debited either to hats or bonnets, the only difference being an accidental one, viz., that the straw employed in the manufactory would probably be obtained by direct purchase, while the green crops are obtained by an indirect outlay of money in labour, manure, horse-food, etc. Thus *crops consumed on the farm* should be regarded as an *item of expense* in the production of meat and, incidentally, also of manure; but *crops sold off the farm* should rank with sheep, etc., as being *articles produced with a view to direct and profitable barter.*

In order to arrive at the true profit arising from the purchase, growth, and sale of an article of farm produce, we have only to get a clear idea of the real expenses attending its production, and of the substantial benefits which in its growth it confers on other departments. The former must be debited, and the latter credited to the article in question. By way of example:

You buy sheep to fatten for the butcher. Sheep account must be debited with the cost of purchase, and by-and-by credited with the proceeds of the sale. The sheep are fed on swedes on the land, and have also a known quantity of oil-cake; at the same time one great object in feeding them on the land is, that the manure arising from both swedes and oil-cake may enrich the succeeding crop of barley. Hence the sheep must be debited with their proportion of the cost of producing the swedes, and barley with the remainder, while green crops are credited[1] with the whole amount; sheep, too, must be debited with their proportion of the cost of the cake, and barley with the remainder, while the granary account is credited[1] with the whole of the cake it delivers. The same principles are applicable to every case that can be conceived, and all that is pre-supposed is an account of outlay on the different crops and of other food, and an approximate knowledge of the proportion appropriated and wasted by animals and left in the manure respectively.

Of the granary and labour books more hereafter; for it is not here that the stumbling-block lies. What appears to many to be insurmountable is the difficulty of knowing how to divide the food consumed between the animals and their manure. Much confusion arises from thinking what is the feeding value of the roots, and how shall we arrive at the yield per acre; but if they are taken at *cost price*, as by the analogy of other businesses all articles grown for home consumption should be taken, then this cost price has merely to be divided in a certain ratio, without regard either to the feeding value per ton, or the acreable yield.

The subject is apt still further to become shrouded with hopelessness by too great straining after exactness. The ratio of food assimilated to manure can only be an estimated one; and, although there can be no objection to any individual seeking gradually to improve the basis of his calculations in accordance with ever-multiplying experiments, to suit the different stages of maturity in animals, the different values of their excrements and even the peculiar conditions of his own farm, yet the writer would strongly recommend that a simple and single figure should *at first* be taken to represent in every case the ratio for oxen, a second for sheep and a third for pigs.

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[1] It must never be forgotten that double entry requires a corresponding credit entry for every debit. Every transaction will be found to create a charge against one or more accounts, and to benefit one or more others.

In a lecture delivered by Mr. Lawes in 1864, before the Royal Dublin Society, a table was given, from which may be gathered, with quite sufficient precision, the ratio between the weight of food assimilated and lost by respiration, etc., and that recovered as manure, the food being in each case of an ordinary kind. Reducing his absolute figures to proportional ones, we have—

	Oxen.	Sheep.	Pigs.
Percentage assimilated and lost, being proportion to be debited to *animals*, ...	63	68	83
Percentage recovered as manure, being proportion to be debited to *crops*, ...	37	32	17
	100	100	100

and, unless any more suitable figures can be suggested, we would recommend that these should be at first adopted, as fitted to give a fairly true average result. It is hoped that those readers whose attention has been given to agricultural experiments will do their utmost to elucidate this point.

The arrangement of a granary book may vary according to the particular requirements. The principles which should regulate the way in which it is kept are the following:—

1. Granary account should be debited with all purchased food,

seed and manure, and with all food and seed for home use which may have been grown on the farm. 2. Granary account should be credited at cost price with all food, seed or manure which it delivers; and 3. it should balance itself and never show any profit or loss, excepting what may unavoidably arise from the measuring out of large quantities in numerous small portions.

The arrangement of a labour book may vary too according to the particulars which it is wished to show. In whatever way it is kept, there must be at the end of every week or fortnight a well-checked abstract of the total expenditure during that period in manual, horse and ox labour on each kind of crop, animal or other account—the cost of ox and horse labour being first estimated at so much per day, and adjusted at the close of the year by apportioning the balance of ox and horse accounts over the different chargeable departments.

One point remains to be noticed. It is often the case that a field is prepared for one crop, and after all is only in part, if at all, placed under that crop. In cases where this may prove to be so, it is easy to charge the cost of cultivation to a temporary account with the field itself, and when the crop or crops are sown, transfer the balance of the account in proper proportions to the debit of those crops.

We have now laid down the *principles* on which farm accounts should be constructed, and the more simply these can be reduced to practice the better. A complete treatise on the different forms of books, and the various cases that may present themselves in practice, would occupy far more space than that at present at our command; but we think that, bearing in mind the cardinal points to which special attention has been directed, the reader will, with moderate perseverance, overcome every apparent difficulty. Again we would urge upon his recollection three things:—1. That every debit must have a corresponding credit; 2. that the whole of everything bought, grown or reared for home use must be charged to the various accounts at cost price, and 3. that simplicity in book-keeping is of the greatest value; and, in matters of estimate, based on experiment and experience, an approximation should satisfy at first, and greater accuracy follow by degrees.

ON THE ABSORPTIVE POWER OF SOIL.

BY

ROBERT WARINGTON, F.C.S.

ON THE ABSORPTIVE POWER OF SOIL.

THE chemistry of soil is a branch of science at present but imperfectly investigated, and confessedly full of difficulties. In its full meaning it implies an acquaintance with all the various forms of matter contained in soil, and also a perfect knowledge of their behaviour under the various conditions to which soil is liable. The chemist has comparatively little difficulty in analysing a soil. He can pull it to pieces, and determine with considerable accuracy the proportion of the various elements which together compose it; but the results thus obtained are only a very partial help in the study of the chemical properties of soil. The analysis fails to tell him in what relation the various elements stood to each other in the original soil, in what forms of combination they actually occurred. The chemist is thus, at starting, only imperfectly acquainted with the compounds present in any particular soil, the chemical properties of which he is about to study. But this is not the only difficulty under which he labours,—he is ignorant, to a very considerable extent, of the properties and behaviour of those substances which he believes to be present. The constituents which make up the bulk of his soil may be classed under certain heads,—as water, quartz, silicates, hydrated oxides, carbonates, and humus; but how little is known respecting the behaviour of most of these substances under the conditions met with in soil? What is their action towards the various salts which form so important a part of plant food? What is their action towards the various gases of the atmosphere? What is their behaviour in the presence of decaying vegetable or animal matter? What again is their influence on each other when present in different proportions? The subject has been too little studied to allow of any but imperfect answers being given to these questions. It naturally follows from this immature condition of the science, that while several of the properties of soil have been very ably investigated, the origin and cause of these properties have been but indistinctly traced. One investigator ascribes a phenomenon to the action of one of the ingredients of soil, while another sees in the same phenomenon the sole action of a different soil ingredient.

In the present paper we propose to confine our attention to one of the best known properties of soils,—their remarkable faculty of withdrawing certain substances from their solution in water.[1] The subject has received attention only in the last twenty years. It has perhaps been more fully investigated than any other part of the chemistry of soil, and richly deserves further study. Did we thoroughly understand it, the whole subject of the condition of plant-food within the soil would be at our command. We might then hope to be able to discriminate between available and non-available plant-food, and agriculture would gain largely by the increase to our knowledge.

Many an observant farmer must have noticed, long before agricultural chemistry had its birth, that soil has the property of removing very quickly the odour and colour of liquid manure; but the observation, however intelligent, resulted in no permanent addition to our stock of knowledge. Near to our own day two thoughtful men noticed this fact, and fortunately each of these observers was acquainted with a chemist. Mr. H. S. Thompson in 1845 made a few careful experiments on the subject, with the assistance of Mr. Spence, a chemist at York, but did not publish his results till five years later. Mr. Huxtable, a short time after, drew the attention of Professor Way to the same subject; the result was the publication in 1850 of Way's now classical paper "On the Power of Soils to absorb Manure,"[1] followed by two other papers in 1852 and 1855. Numerous chemists have since made researches on the subject, especially in Germany, and the subject is still being vigorously prosecuted. We propose to give some account of the results arrived at, and the principal opinions held respecting this property of soils, and also a short description of some experiments recently made at the College upon the same question.

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[1] The absorptive action of soil towards the gases of the atmosphere has been but little investigated, and must be passed over for the present.

Way treated various soils and clays with solutions of ammonia, and with solutions of carbonate, sulphate, and chloride of ammonium. He repeated the same experiments with potash, and with carbonate, sulphate, nitrate, and chloride of potassium. Experiments were also made, though fewer in number, with salts of sodium, calcium, and magnesium. He found that when solutions of ammonia, potash, or of their carbonates, were filtered through ten or more inches of soil, these salts were absorbed to such an extent that their presence could not be detected in the filtered liquid till a very considerable amount of the salt solution had been applied, and the soil had in fact become partially saturated. In the case of the carbonates, the carbonic acid as well as the base of the salt was generally retained by the soil; but when the other salts of ammonium and potassium were applied in the same manner, the base only of the salt was absorbed, and the filtered liquid contained the nitric acid, sulphuric acid, and chlorine, united with calcium,[1] derived from the soil or clay experimented on. The salts of sodium were acted on by soil in the same manner as the salts of ammonium or potassium, but the absorption was less energetic. Solutions of caustic lime, and of bicarbonate of calcium, were deprived of their calcium by passing through soil. Magnesium was also absorbed from solutions of its salts. In an experiment with a solution of phosphate of sodium, the phosphoric acid was found to be perfectly retained by the soil. A solution of superphosphate was also completely deprived of its phosphoric acid by filtering through soil. From all these experiments Way came to the conclusion that the affinity exhibited by soils was directed solely towards basic substances. Sulphuric, hydrochloric, and nitric acid were apparently not absorbed from their salts; and he was of opinion that the retention of carbonic, and phosphoric acid, by soil, was due only to their forming insoluble compounds with the lime of the soil. The absorption of bases from the solutions of their sulphates, chlorides, nitrates, etc., he considered was owing to the decomposition of these salts by the lime in the soil; the lime by combining with the acid, left the base free for absorption.

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[1] *Journal, Royal Agricultural Society*, xi. 313.

Way further determined the amount of the absorption in the case of several soils and clays; and in these experiments, instead of filtering the solution of salt through the soil, a weighed portion of the soil was shaken with a known quantity of the salt-solution, and the extent of the absorption determined from the amount of salt showed by analysis to have disappeared from the solution. This method of experiment has been generally adopted by succeeding investigators, though, as we shall see further on, it is not without its disadvantages.

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[1] In experimenting with a clay derived from a soda felspar, Way found the filtered liquid to contain sodium salts, in place of the calcium salts usually found.

Before discussing the explanations that have been offered by Way, and succeeding investigators, of these remarkable properties of soil, it will be well to put the reader in possession, as far as possible, of the facts connected with soil absorption, which have been gradually accumulated.

All soils seem to possess this property of removing certain bases and acids from solution. The faculty is not confined to one class of soil, but is likewise enjoyed by clay, marl, loam, light sand-soil, or peat-soil. The faculty is not, however, possessed by all soils in the same degree, some soils exhibiting a very considerable absorptive power, while the capabilities of others in this direction are but small. Again, soils differ in their behaviour towards the different classes of salts. Two soils that are equal in absorptive power for free ammonia, are not perhaps equal in their power of absorbing sulphate of ammonium. It was shown in Way's experiments that the lime contained in soil took an important part in the action of the soil upon sulphates, nitrates, and chlorides,—a fact which has been abundantly confirmed by other researches. We can therefore easily understand that, in the absence of lime, and of substances playing a similar part, the absorptive power of a soil for certain salts must be materially affected.

It must not be supposed that the salts named above as used in Way's research are the only substances which soil is capable of absorbing. If sewage, or liquid manure, be passed through soil, it will be found that nearly the whole of the organic matters held in solution have been removed—the offensive sewage will have become clear water. Here we have a large class of bodies, of which chemists know very little, which soil is clearly capable of absorbing. Again, there can be no doubt that the same action which determines the absorption of potassium or sodium, would equally determine the absorption of the rarer alkaline metals—lithium, cæsium, and rubidium; or that the salts of the other metals would generally be found to undergo, in contact with a soil containing lime, a similar change to that which sulphate of magnesium and other salts are known to undergo. The list of substances that come under the power of soil absorption is in fact a very large one. Chemists have, however, done wisely in concentrating their study upon the commoner salts of those bodies which are known to be an essential part of plant-food, and are, consequently, always present in fertile soils. An acquaintance with the action of the soil towards these bodies is most important, and they have naturally received the chief share of the attention bestowed on this subject.

Different bases are not equally absorbed by soil. Few experiments have, however, been made that allow of an exact comparison. Way found that a clay, treated respectively with chloride of ammonium, and nitrate of potassium,—the salts being used in the proportion of their chemical equivalents—took up a larger percentage of the ammonium than of the potassium; although, at the same time, a greater quantity of the potassium was absorbed. In experiments by Küllenberg,[1] in which each salt was also used in its equivalent proportion, the bases were taken up by the soil in the following order, regard being had to the proportions of the equivalent absorbed:—ammonium, potassium, magnesium, calcium, sodium. The absorptive energy of both soil and clay was thus, from a chemical point of view, greatest for ammonium.

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[1] *Jahresbericht der Agrikultur-Chemie*, 1865, p. 15.

Not only is there this difference with regard to various bases, but experiment has shown that a base is not equally absorbed by soil from its various salts. The hydrate, the phosphate, and carbonate appear to be the salts from which the soil takes up the largest quantity of base; while from the sulphate, nitrate, and chloride the soil generally removes a notably smaller quantity.[1] Of the last three salts, the greatest absorption is usually from the sulphate. Only a few series of experiments have been published in which the behaviour of the same soil towards various salts is fairly compared. It is essential for such a purpose that the solutions of the various salts employed should each contain, not the same proportion of salt to water, but the same proportion of *base* to water;—that, in fact, each salt should be used in the proportion of its chemical equivalent. It is also necessary that a constant proportion be maintained between the weight of soil and the volume of salt solution throughout the experiments. The earlier experiments on soil absorption were not made with this exactness. Küllenberg has recently published an elaborate series of experiments upon one soil, employing each salt in its equivalent proportion, and in five states of dilution. Taking the total absorption in each five experiments as representing the absorptive power of the soil for the particular salt employed, and calling the greatest absorption in each series 100, we have the following as the proportion in which the bases were removed from their various salts:—

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[1] Some soils appear capable of removing about equal quantities of ammonia from solutions of free ammonia, and of the three salts just named.

COMPARATIVE ABSORPTION, FROM DIFFERENT SALTS OF THE SAME BASE.

(*The greatest absorption reckoned as* 100.)

	Ammonium.	Potassium.	Sodium.	Magnesium.	Calcium.
Phosphate,..	100	100	100		
Carbonate,..	62	95	85		
Sulphate, ...	56	72	48	100	100
Nitrate,.....	48	58	53	84	64
Chloride,....	45	57	60	81	81

We see that in every case the soil retained most base from the solution of the phosphate and carbonate, and that the sulphate stands next highest, except in the case of sodium. Henneberg and Stohmann,[1] experimenting on a garden soil with salts of ammonium, found the absorption of ammonium from the various salts to be in the following order:—phosphate, hydrate, sulphate: the absorption from the chloride and nitrate was about equal, and the smallest of any. E. Peters[2] found the following order of absorption with salts of potassium:—phosphate, hydrate, carbonate, bicarbonate, nitrate, sulphate, chloride. Fraas,[3] using lysimeters as the vessels for his experiment, found the absorption of potassium salts to be in the order of carbonate, sulphate, nitrate. The only experiments I know of respecting the absorption of phosphoric acid from its various combinations, are those by Küllenberg, forming part of the series already referred to. He employed the phosphates of potassium, sodium, and ammonium, and found the proportion of acid removed by the soil from these salts to be as 100 for the potassium salt, 87 for the sodium, and 68 for the ammonium. The whole of this branch of the subject requires further research.

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[1] *Jahresbericht der Agrikultur-Chemie,* 1858-9, p. 25.

[2] *Ibid.* 1860-1, p. 9.

[3] *Ibid.* 1861-2, p. 11.

The quantity of a substance which a soil will take up when shaken with a solution of it, is found to depend very much upon the strength of the solution. The following rule has been thoroughly established by a number of observers :—Soils remove the greatest proportion of base from a salt solution when that solution is weak, but they take up the greatest quantity when the solution is strong. Thus in one of Küllenberg's experiments, 100 grms. of soil took up ·2360 grms. of potash from a solution of the sulphate, while from a solution of $\frac{1}{5}$th the strength the same weight of soil only absorbed ·0977 grms.; but in the first case only 21·1 per cent. of the total potash was taken up, while in the last the absorption was 43·8 per cent. The first part of this law probably holds good only in those cases where, as in the experiments from which it is deduced, the salt is in excess of the soil. A strong and weak solution poured in each case upon an *excess of soil* would, we conceive, have their salt equally removed, unless, indeed, the stronger solution was so concentrated that it failed to moisten the bulk of soil necessary for its absorption. It is said by many investigators that a soil never removes the whole of a substance from solution. This may, perhaps, be true when taken in its absolute sense. The proportion of the salt removed must, however, greatly depend on the volume of soil employed. If, as in most experiments, the soil is shaken up with four or five times its bulk of liquid, a notable quantity of the salt will remain unabsorbed; but if the soil be used in excess, and the liquid filtered through it, as in Way's original experiments, the absorption of ammonia, potash, and phosphoric acid, will be found to be all but complete, minute traces only appearing in the filtrate; a fact amply attested by the analysis of drainage waters from cultivated fields.

The bases absorbed by soil are to some extent given up again when the soil is treated with water. Voelcker found that a soil which had taken up ammonia from solutions of the hydrate, sulphate, and chloride, gave back again half of the quantity absorbed when washed from four to seven times with four times its weight of water, the water remaining in contact each time for several days. E. Peters found that a soil which had absorbed potash, gave up about 1 part of potash to 30,000 of water, but that the potash was much more soluble in water containing carbonic acid. The information we have on this head is very scanty; more experiments are much needed.

A further point that has been noticed respecting the absorptive action of soils, is the displacement of one base by another. We have already seen in Way's experiments how the absorption of ammonia or potash from their salts is generally attended by the separation of lime from its combination in the soil. In the same way a soil saturated with ammonia gives up a part of its ammonia when treated with a potassium salt, and potash to some extent replaces the ammonia in the soil. This action, too, has been but little studied, though practically of great importance. Voelcker has pointed out that the beneficial action, upon some soils, of common salt, may be owing to the displacement by the soda of some of the more valuable constituents of plant-food which the soil contains.

We have now to consider the various explanations which have been offered of these remarkable phenomena of soil absorption.

In Way's first paper no attempt is made to establish a theory respecting the absorptive power of soils. He plainly states that he considers the operation a purely chemical one, and hints that the absorptive faculty resides in some constituent of clay. He shows by experiment that ignition of a soil or clay greatly diminishes its absorbing power; that treatment with strong acid till all soluble matter is removed fails to extinguish the absorptive power, though more or less diminishing it. In his second paper, Way describes a series of experiments with certain artificially prepared hydrated double silicates, which satisfied him that it was to the presence of such compounds in soils that their absorptive power was to be attributed. Way took a solution of silicate of sodium, and poured it into a solution of alumina in soda: the precipitate that formed was a double silicate of aluminium and sodium. This compound, if treated with lime water, or a solution of any calcium salt, gave up soda and absorbed lime. The resulting double silicate of aluminium and calcium, if treated with a salt of potassium, gave up lime and absorbed potash. If the sodium, calcium, or potassium salts, were treated with a salt of ammonium, they gave up soda, lime, or potash, and absorbed ammonia. In fact, as far as the experiments went, all the principal features which mark the absorption of bases by soil were displayed in still greater energy by these artificially prepared silicates. The affinity of the silicate of aluminium for bases appeared to be greatest for ammonia, and least for soda; salts of ammonium would decompose any of the other silicates. The silicate of aluminium and calcium had the power of absorbing ammonia gas from the atmosphere. All the silicates possessed a very considerable degree of insolubility.

The explanation of the absorptive action of soils thus put forth by Way, has not met with unanimous acceptance among agricultural chemists. It would be tedious to narrate the views and conclusions of each experimenter, founded as they are in many cases on very limited data, but we may point out the principal divisions of opinion.

Way's opinion, that the absorption by soil was a result of the chemical combination of the substance absorbed with some constituent of the soil, has been, on the whole, generally shared by subsequent experimenters. Some, as Rautenberg, and E. Heyden, have supported Way's theory of silicates in its entirety, and have sought to show that the absorptive power of a soil is in proportion to the amount of silicates (decomposable by the alternate action of hydrochloric acid and carbonate of sodium) which it contains. Others, as Knop, and Voelcker, while not denying the absorptive power of silicates, have pointed to the hydrated oxides of iron and aluminium as a further and important source of the absorptive energy of soils. Others again, have experimented with the organic matter of soils, that assemblage of little-known bodies that usually goes by the name of humus, and have shown that it too to some limited extent possesses absorptive powers.

Besides these opinions, all of which take a chemical view of the question, we have the wholly different view put forth by Liebig, who considers that the absorption of the various substances by soil is not in any way a result of chemical combination, but is merely a consequence of the "physical attraction" of a highly porous body. We are referred to the well-known power of charcoal of removing certain substances from their solution in water, in consequence of which property it is so largely used as a decolorizing agent. The ordinary process of dyeing is quoted as another illustration of the same action; where certain organic colouring matters are removed from solution by the vegetable or animal fibre, and remain very permanently united to it. We are told there is in these cases no chemical combination between the absorbent and the substance absorbed, that the action is the result of mere physical attraction, and that the absorbent powers of soil are nothing more than a manifestation of the same action towards certain inorganic salts. It will be as well to state the view taken by Liebig in his own words:[1]

> There can be no doubt that all the component parts of arable soil have a share in these properties, but only when they possess a certain mechanical condition, like wood or animal charcoal; and that this power of absorption depends, as in charcoal, upon a surface attraction, which is termed a physical attraction, because the attracted particles enter into no combination, but retain their chemical properties.
>
> The term "physical attraction," as used here, does not signify a peculiar attractive force, but merely designates the ordinary chemical affinity, which shows differences of degree in its manifestation.
>
> . . . .
>
> From a solution of carbonate of potash or ammonia, or from a solution of phosphate of lime in carbonic acid water, the arable soil will withdraw the potash, ammonia, and phosphoric acid, without any chemical interchange with the constituents of the earth taking place.

We will not at present inquire whether Liebig's view of the subject, or the views of other chemists already quoted, are more in harmony with the facts of the case, but will only just remark that Liebig's description of the attractive power of soil and other absorbents as nothing more than an instance of "ordinary chemical affinity," seems hardly consistent with the other statements he makes regarding this property. Liebig tells us that *all* the component parts of arable soil have a share in this chemical affinity, if only they possess a sufficiently porous texture. Now we can readily understand that an insignificant chemical affinity may be greatly exalted by increasing the surface of the acting body; but that the various constituents of soil, differing as they do so greatly in their chemical nature, should all of them, if they display the necessary amount of surface, exhibit the same *chemical* affinity for the same substances, is more than a chemist will readily believe. This, however, is what is virtually assumed by Liebig. He tells us, "there is no perceptible connexion between the composition of a soil and its power of absorbing potash, ammonia, and phosphoric acid." If mechanical texture is everything, and the chemical properties of the material nothing, the phenomena in question must clearly be physical and not chemical.

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[1] *The Natural Laws of Husbandry*, pp. 67-69.

We now pass to the experiments made in the College Laboratory,[1] after an account of which we will attempt a review of the whole subject.

The investigation we are about to describe was confined to the single inquiry, What is the part taken by oxide of iron and alumina in the absorptive action of soils? In a previous number of this journal an account has already been given of the earliest of these experiments.[2] It was then stated that both hydrated oxide of iron and alumina possessed in a remarkable degree the power of removing phosphoric acid from the solution of a phosphate. The experiment was made with a solution of phosphate of calcium in carbonic acid water, and it was found that by contact with a relatively small bulk of either of these hydrates, 96 to 97 per cent. of the phosphoric acid originally present was withdrawn, while the calcium was left dissolved in the liquid in the form of carbonate. The chemical decomposition of the phosphate of calcium was thus all but complete; a basic phosphate of either iron or aluminium was produced, and the calcium, at the end of the reaction, was united to carbonic in place of phosphoric acid. These results suggested the question, Whether the property of soils of withdrawing phosphoric acid from the solutions of its salts, was not owing to the presence in soils of oxide of iron and alumina? whether, in fact, the absorption of phosphoric acid was not a simple consequence of the chemical affinity existing between it and these hydrated oxides? The next experiments were made with the object of testing the correctness of this conclusion. Did soil comport itself towards a solution of a phosphate in a manner similar to that shown by oxide of iron under the same circumstances?

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[1] These experiments were made by the writer in 1865-7, while assistant-teacher of Chemistry at the College.

[2] *Practice with Science*, i. 333.

In the experiments with soil, the same method was followed as in the experiments with the pure hydrated oxides. The soil was placed in contact with a solution of phosphate of calcium in carbonic acid water, the liquid being kept saturated with the gas, and after some days the amount of calcium and phosphoric acid removed from the solution was ascertained. If no chemical action had been exerted by the soil, the phosphate of calcium would be either unaffected or absorbed as such, equal proportions of calcium and phosphoric acid being removed from the solution. If, however, the soil acted in a manner similar to the oxide of iron, the phosphate of calcium would be more or less decomposed, its acid withdrawn, while the calcium remained dissolved. A little reflection, however, showed that perfectly sharp results could not be expected in experiments with soils, from their well-known behaviour towards solutions of carbonic acid and solutions of calcium salts. A soil containing lime will give up a portion of it if treated with a solution of carbonic acid. If such a soil were used for the experiment, calcium might be expected to pass from the soil into the solution; and if at the same time a portion of the phosphate were absorbed, it would appear as if the phosphate had been decomposed without this having perhaps occurred, since an excess of calcium would be shown by analysis to exist in the remaining solution. On the other hand, most soils absorb carbonate of calcium from its solution in carbonic water; and operating with such a soil, the carbonate of calcium, resulting from the decomposition of the phosphate, would itself be absorbed by the soil, and thus the evidence of the decomposition be lost.[1] It was thought safer to avoid the former error, and to choose soils for the trial which did not yield calcium to carbonic acid water, since in this case, though the decomposition of the phosphate might appear but small, from the subsequent absorption of the carbonate of calcium, there could be no question as to its reality if found to occur to any appreciable extent.

The two soils employed had the following composition :—

	Soil A.	Soil B.
Moisture, ...	1·54	6·57
Organic and volatile matter, .	3·69	17·03
Silica and insoluble silicates, .	87·31	55·29
Oxide of iron and alumina, .	6·82	19·31
Phosphoric acid, . . .	·05	·34
Lime, ...	·11	·28
Magnesia, ...	·14	·63
Potash, ...	·16	·55
Carbonic acid, traces of other substances, and loss, . .	·18	
	100·00	100·00

Notwithstanding the very small amount of lime in these soils, they were found to give up some of it when digested with carbonic acid water. The portion of soil taken for experiment was therefore repeatedly digested with carbonic water, and as this removed the lime but slowly, the soils were in the earlier experiments further treated with weak acetic acid, and then thoroughly washed with water: all soluble calcium salts were thus removed.

In the first two experiments, 600 grs. of soil were treated with 8000 grs. of a solution of tricalcic phosphate in carbonic water, and carbonic acid gas was passed through the mixture from time to time. At the end of eighteen days the solution was removed from the soil and analysed. Analysis showed that soil A had absorbed 50·8 per cent. of the phosphoric acid originally present, and 43·2 per cent. of the lime; while soil B had absorbed 96·1 per cent. of the phosphoric acid, and 61·5 per cent. of the lime.

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[1] Theoretically there would be for every soil a certain strength of solution of carbonate of calcium in carbonic water, in which the soil would neither give up nor absorb lime.

The experiment with soil B was once more repeated; the soil was this time not treated with acetic acid, but washed with carbonic water only. 400 grs. of the soil were treated as above with 8000 grs. of a solution of tricalcic phosphate. After six days the liquid was removed and analysed. The soil had in this instance absorbed 93·8 per cent. of the phosphoric acid, and 49·0 per cent. of the lime.

In all these experiments there was evidently a decomposition of the phosphate of calcium by the soil, this being most marked in the case of soil B; in each experiment there was, however, a very considerable absorption of lime as well as of phosphoric acid. It was in fact proved in every case that a part of the phosphoric acid absorbed had been withdrawn by chemical action, but in no case did the proof extend to the whole of the phosphoric acid removed by the soil. We have already noticed that the property possessed by soil, of absorbing carbonate of calcium from its solution in carbonic acid, necessarily deprived us of the evidence requisite to complete the proof.

That there might be no doubt that the soils experimented with had the faculty of removing carbonate of calcium from a carbonic solution, a trial was made with soil B—the soil which had given the greatest absorption both of lime and phosphoric acid. 400 grs. of this soil were placed in contact with a weak solution of carbonate of calcium in carbonic acid water, the experiment being conducted as before. At the end of six days the soil had withdrawn 27·4 per cent. of the carbonate of calcium present.

The experiments with soil might doubtless have been extended with advantage; the evidence was, however, sufficient to convince me, that the natural hydrated oxide of iron contained in soil behaved in the same manner towards phosphoric acid as the artificially prepared hydrate had been found to do in the earlier experiments..

The concluding investigation was upon the absorptive power of the hydrated oxides for salts of potassium and ammonium. Hydrated oxide of iron and hydrated alumina were prepared by precipitation; they were very thoroughly washed by decantation before use. Known quantities of these hydrates and of the various salt solutions were then mixed, and after contact for a day or two, the amount of absorption was ascertained by an analysis of the liquid. The following tables show the amount of absorption ascertained for each salt; the figures given are in most cases the mean of several experiments:[1]—

ABSORPTION OF SALTS OF POTASSIUM BY HYDRATED FERRIC OXIDE AND HYDRATED ALUMINA.

SALT EMPLOYED.	Strength of Solution.		Amount absorbed by 100 of Hydrated Ferric Oxide. ($Fe_4 H_6 O_9$)*		Amount absorbed by 100 of Hydrated Alumina. ($Al_2 H_6 O_6$.)*	
	Per cent. of Salt.	Per cent. of Potash.	Calculated as Salt.	Calculated as Potash.	Calculated as Salt.	Calculated as Potash.
Carbonate of Potassium,	·995	·678	7·17	4·89	1·49	1·02
Sulphate of Potassium,	1·077	·582	1·94	1·05	·55	·30
Chloride of Potassium,	1·053	·664	·36	·23	No trial.	
Nitrate of Potassium,	1·049	·488	·38	·18	·27	·12

* These formulæ represent the composition of the hydrates actually employed.

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[1] For the analytical details the reader is referred to the *Journal of the Chemical Society*, vol. vi. p. 1.

ABSORPTION OF SALTS OF AMMONIUM BY HYDRATED FERRIC OXIDE AND HYDRATED ALUMINA.

SALT EMPLOYED.	Strength of Solution.		Amount absorbed by 100 of Hydrated Ferric Oxide. ($Fe_4 H_6 O_9$.)*		Amount absorbed by 100 of Hydrated Alumina. ($Al_2 H_6 O_6$.)*	
	Per cent. of Salt.	Per cent. of Ammonia.	Calculated as Salt.	Calculated as Ammonia.	Calculated as Salt.	Calculated as Ammonia.
Carbonate of Ammonium,	·930	·329	5·40	1·91	2·04	·72
Sulphate of Ammonium,	1·382	·356	2·17	·56	·74	·19
Chloride of Ammonium,	·958	·304	·20	·07	No trial.	
Nitrate of Ammonium,	1·552	·330	·35	·08	No trial.	

* These formulæ represent the composition of the hydrates actually employed.

Two points strike us at once on inspecting these tables. In the first place, the absorbent action of alumina is clearly much less than that of ferric oxide. With carbonate and sulphate of potassium the oxide of iron takes up about four times as much as the alumina, with the corresponding ammonium salts it takes up about three times as much as the alumina.

In the next place, it is very evident that both with oxide of iron and alumina the amount of absorption varies greatly with different salts of the same base.[1] The carbonates of potassium and ammonium are seen to have been absorbed to a considerable extent, the sulphates to a small extent, while of the chlorides and nitrates only traces were taken up. This order of absorption, it will be remarked, is the same as that generally observed in absorption by soil. With soil, however, the absorption from the sulphate, chloride, and nitrate, is proportionately far greater than in the present case. The difference is doubtless owing to the important assistance given by the lime of soil, which, combining with the acids of these salts, allows the bases to be absorbed as hydrates. It was attempted in a few experiments to imitate the conditions of soil by adding carbonate of calcium to the hydrated oxides. Some further absorption was obtained in a few cases by this means, but the imitation of the conditions of soil was clearly very imperfect.

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[1] The reader will observe, by reference to the table, that the strength of the salt solutions employed was not in every case regulated by the chemical equivalent of the salt. In this, and several other particulars, the experiments admit of considerable improvement. These errors, pointed out by experience subsequently gained, do not however affect any of the conclusions here drawn.

It was a point of great importance to decide if the absorption in these experiments was due to a chemical or a physical action. With this view attention was paid to any evidence of a decomposition of the salt during the reaction.

In the case of carbonate of potassium, it was found that the carbonic acid was not absorbed to the same extent as the potassium, but that an excess of acid remained in every instance in the final solution. In three experiments with hydrated ferric oxide there were absorbed for 10 equivalents of potassium, 3·6, 4·5, and 7·9 equivalents of carbonic acid. The proportion of carbonic acid absorbed was thus very various. The variation was evidently connected with the amount of potassium removed from solution, as the following figures will show :—

	Potassium absorbed for 100 originally present.	Equivalents of Carbonic Acid absorbed for 10 of Potassium.
Experiment 1, ...	6·84	3·6
Experiment 2, ...	18·67	4·5
Experiment 3, ...	32·57	7·9

Thus the weaker the solution became the greater was the proportion of carbonic acid absorbed. It seems that ferric oxide commences by absorbing potash almost to the exclusion of carbonic acid; by so doing the proportion of carbonic acid in the liquid must be increased: but this accumulation of acid in the liquid appears to act as a check on the further decomposition of the potassium salt, which therefore takes place to a less and less extent as the absorption progresses. In one experiment with hydrated alumina the decomposition of the carbonate of potassium was complete, potash was taken up, but no carbonic acid.

In the experiments with carbonate of ammonium the absorption of carbonic acid was determined in one instance only. The ferric oxide in this case absorbed carbonic acid and ammonia in the proportions to form neutral carbonate: the salt used had contained, as is usual with the commercial article, an excess of carbonic acid,—a slight decomposition had, consequently, taken place.

In the experiments with sulphates it was noticed that the solution of sulphate of ammonium became distinctly alkaline on contact with either ferric oxide or alumina; with the latter the reaction was very marked. A determination of the amount of sulphuric acid and ammonia removed by the alumina showed, that for 10 equivalents of ammonia 28·2 equivalents of sulphuric acid[1] had been taken up. The acid had here been absorbed in far greater proportion than the base. Solution of sulphate of potassium became slightly alkaline on contact with alumina; with oxide of iron no change was observed.

Solutions of chloride and nitrate of ammonium became alkaline on contact with ferric oxide, showing that the acid was taken up to a greater extent than the base; the parallel experiments with alumina were here deficient. The corresponding potassium salts were unaffected by contact with ferric oxide.

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[1] By an equivalent of sulphuric acid is here understood the amount required to form sulphate of ammonium with one equivalent of ammonia.

We have here very distinct evidence that the absorption by ferric oxide and alumina was attended with a chemical decomposition of the salt absorbed; this decomposition was, however, rarely complete, both acid and base being in most cases taken up, though in unequal proportions. To a chemist, alumina and ferric oxide are known to behave as feeble bases towards strong acids, and as feeble acids towards strong bases; we can therefore, from a chemical point of view, readily understand the preponderating absorption of base from the salt of a weak acid, as a carbonate, and the preponderating absorption of the stronger acids from their comparatively feeble combinations with ammonium. Again, the well-known readiness with which ferric oxide and alumina form highly basic compounds, and also salts (as alum) containing two bases to one acid, seems to render a purely chemical explanation of the whole of these reactions quite easy. It is not, however, denied that hydrated ferric oxide and alumina are capable of taking up certain substances by virtue of physical attraction, but it is believed that such an action has had no place in the absorption of the salts here described.

A single experiment was made as to the retention of potash by ferric oxide when the latter was washed with water. Hydrated ferric oxide, which had absorbed potash from the carbonate, was submitted to two washings with thorough agitation, each washing remaining in contact one day. The ferric oxide was then found to have lost two-thirds of its potassium. The washing was sufficient to have reduced a perfectly soluble salt to $\frac{1}{144}$th its original quantity. The compound with iron was thus decomposed by water, but with some difficulty.

Having thus described the results obtained in the College Laboratory, we will now attempt to point out those conclusions with regard to the phenomena of soil absorption which the accumulated facts of the case seem to warrant.

The question which chiefly demands attention is the nature of soil absorption. Is it a physical or chemical action, and by what ingredients of the soil is it exerted? In order to form a definite notion concerning the first part of this question, let us, in the first place, inquire, What is physical attraction? We will take the decolorizing power of charcoal as an example of this action.

Liebig tells us, and we believe rightly, that the attraction of the charcoal for the particles of colour is quite similar to the attraction by which these particles were previously dissolved and held in solution by water. "If the attraction of the charcoal is somewhat greater than that of the water, then the colouring matter is completely withdrawn from the water; if the attraction of both is equal, a division takes place, and the extraction is only partial."[1] Liebig, however, characterizes this power of charcoal as *chemical*: "This power in charcoal depends upon a chemical attraction proceeding from its surface."[2] Other chemists affirm, on the contrary, that the attraction of both charcoal and water is simply a case of physical adhesion; the same action by which a stick dipped in water comes out wetted. Against the chemical hypothesis it may be urged with force, that, to use Liebig's own words, "the materials attracted by the charcoal retain all their chemical properties;" so that on this view we really have chemical action taking place without any chemical change resulting. In support of the second hypothesis, it may be observed that charcoal appears to attract chiefly those substances which are sparingly soluble in water; those, in fact, for which water has a small adhesive power, that may with comparative ease be overcome.[1]

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[1] *The Natural Laws of Husbandry*, p. 66.

[2] *Ibid.* p. 65.

Assuming, then, as most probable, that the action of charcoal and other similar absorbents is owing to the physical attraction of adhesion, we have next to ask, Is this physical attraction exerted by soil, and can the absorptive properties of soil be thus explained?

It seems very probable that physical attraction is exercised by soil, and that the clarifying action of clay, and of soils generally, when brought in contact with sewage and similar solutions, is mainly owing to an absorbent action very similar to that exerted by charcoal under the same circumstances. But this physical action of soil we believe to have little or nothing to do with the absorption of ammonia, potash, phosphoric acid, and generally of those salts which form an important part of plant food. Charcoal appears to be quite incapable of removing ammonia from solution, and it seems, indeed, unlikely that so soluble a substance should be removed from solution by the force of adhesion of any solid body. The same may be said of many other soluble salts readily taken up by soil, but unaffected by charcoal. The probability of the action of soil in these cases being due to physical attraction is therefore very small. On the other hand, we have considerable evidence of chemical action in the absorption of many substances by soil; the evidence is perhaps strongest in the case of phosphoric acid.

It is now allowed by most agricultural chemists that the hydrated ferric oxide and alumina of soil unite with the phosphoric acid applied in manure, and form basic phosphates of iron and aluminium. We have already described some experiments which appear satisfactorily to establish this reaction between soil and phosphoric acid. E. Peters has also recently published a research upon the same subject.[1] He endeavoured to ascertain the state in which phosphoric acid was held in soil, by acting on a soil, recently manured with bone dust, with different solvents. He came to the conclusion, "that the phosphoric acid in soils is almost entirely combined with ferric oxide and alumina;" and "that from a solution of phosphate of calcium in carbonic acid, phosphoric acid is taken up by soils only when the latter contain compounds of alumina or ferric oxide; soils deprived of these compounds by treatment with acids are indifferent to the phosphatic solution." His conclusions thus perfectly agree with those stated above; the absorption of phosphoric acid by soil is considered to be a purely chemical operation.[2]

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[1] For some excellent observations on the subject, see Miller's *Chemistry*, i. 73-75.

If we turn to the phenomena which attend the absorption of bases from their salts, we also find considerable evidence of chemical action. The facts we refer to have been already noticed. We have seen that soil acts differently towards various salts of the same base; that phosphates and carbonates are taken up by soil in greater quantity than sulphates, chlorides, or nitrates. This preference is certainly due to the chemical relations of the various acids to the constituents of soil. The reaction between a soil and an alkaline phosphate will, after the previous discussion, be quite plain to us; the acid of the salt will be appropriated by the ferric oxide or alumina, and the base be thus left in the form of hydrate, the form most favourable to combination. Carbonates are known to all chemists as salts that are easily decomposed, even by bodies of feeble acid properties; the ready absorption of bases from their carbonates might therefore naturally be expected. The carbonic acid liberated, probably in most cases combines with the lime of the soil. In one of Way's experiments, in which a solution of carbonate of ammonium had been poured upon soil, bicarbonate of calcium was found in the water which drained through. Sulphates, chlorides, and nitrates are not taken up by soil to any appreciable extent unless the soil already contains lime, magnesia, or soda; or to speak more accurately, some base for which the absorbing ingredients have a smaller affinity than they have for the base of the salt presented to them. In the majority of cases lime is the active base in these reactions, and the acids of the salts are found combined with lime in the drainage water from the soil. Way showed in the case of a chloride, and Voelcker in the case of a chloride and nitrate, that none of the acid of the salt was absorbed by the soil. The salts had been decomposed by the lime of the soil, and their bases only had been removed from solution.[1]

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[1] *Annalen der Landwirthschaft*, 1867, p. 31.

[2] When a solution of superphosphate is applied to soil, the phosphoric acid is probably in the first instance *precipitated* by the lime of the soil; the action of the ferric oxide is in this case subsequent and gradual.

Facts, in short, show very clearly, that when the solution of a salt is brought in contact with soil the salt is always decomposed if absorption takes place; this decomposition is, of course, a plain case of chemical action. We have been able to give a tolerably satisfactory account of all these reactions as far as the acids of these salts are concerned. We are not able to account so certainly for the bases; they are absorbed by the soil; but with which of the ingredients of the soil do they combine? We cannot trace their course in the reaction, and are obliged to resort to secondary evidence.

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[1] We should expect from the results obtained when sulphate of ammonium was placed in contact with hydrated alumina and ferric oxide, that under some circumstances sulphuric acid would be retained in the soil to an appreciable extent. Curiously enough, this fact was noticed by Mr. H. S. Thompson in his original experiments of 1845. I have found no reference to it since. He observed that a solution of sulphate of ammonium became *alkaline* on being filtered through soil. The reaction would probably be observed in the case of soils rich in the hydrated oxides, but poor in lime.

We have already mentioned two classes of bodies which experiment has shown capable of removing bases from the solutions of their salts; these are the hydrated double silicates, and the hydrated oxides of iron and aluminium. Now, if these compounds can be proved to exist in soil, we are certainly warranted in concluding that the absorption of bases by soil is due to a greater or less extent to their influence.

There is no doubt whatever as to the occurrence of hydrated ferric oxide in soils; it is probably a universal ingredient of soil, and is often present in very considerable amount. The occurrence of hydrated alumina in soils is doubted by some chemists; it is, in fact, difficult to tell to what extent the alumina found in soil is combined with silica, and to what extent it exists merely as hydrate. The question does not, however, materially affect our argument, as we have seen that ferric oxide is apparently a far more efficient absorbent of bases than alumina. We may consider it, therefore, as established, that the ferric oxide present in soils plays a part in the absorbent action of soil towards bases, and that the bases absorbed by soil become, in part at least, united to ferric oxide.

It is very difficult to prove the presence in soils of the particular class of double silicates which Way has shown to possess such a remarkable power of removing potash, ammonia, and other bases from solution.[1] That soils contain both silicates, and hydrated silicates, does not admit of doubt; in fact silicates are often the largest constituents of soil; but that the hydrated silicates are silicates of aluminium and calcium, is more than chemical analysis has yet been able to decide. The probability that such silicates are present is, however, very great. The felspars and micas, from the disintegration of which the silicates of soil are chiefly formed, are all of them double silicates of aluminium with potassium and some other alkaline or alkaline-earthy base; that in the decomposition of these, hydrated double silicates of a similar constitution should be formed, is certainly to be expected. There appears, in fact, no ground for reasonable doubt that the silicates described by Way are really present in soils, and we must, consequently, ascribe to these silicates a part in the absorbent action of soil.

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[1] Eichhorn has examined the properties of chabazite, a native hydrated silicate of aluminium and calcium; he found that, placed in contact with

There yet remains another ingredient of soil which probably takes some part in the absorption of bases,—this is the humus. Humus, or rather the various bodies which compose it, possesses a feeble acid character, and being insoluble in water, or nearly so, is very probably capable of forming insoluble compounds with bases. Brustlein[1] has experimented with pure humus obtained from a decaying oak. He found it to possess a considerable power of absorbing free ammonia, but with solutions of the salts of ammonium it failed to effect any absorption. Since soils and clays almost destitute of organic matter often possess high absorbent powers, the part taken by humus is probably of inferior importance.

We have, then, considerable evidence that soil contains ingredients that have the property of forming more or less insoluble compounds with bases, and are known to be capable of withdrawing bases from solution. Though, therefore, we

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a solution of chloride of ammonium, it absorbed a large quantity of ammonia and parted with lime, and in other respects comported itself like Way's artificially prepared silicate.

[1] *Jahresbericht der Agrikultur-Chemie*, 1859-60, p. 1.

are unable to trace the mode of combination of the bases absorbed by soil, we conclude, upon the evidence thus before us, that they are combined either with hydrated metallic oxides, with hydrated double silicates, or possibly with humus.

Our conclusions respecting the cause and manner of soil absorption may be summarized as follows :—

I. It appears that the hydrated ferric oxide and alumina of soil have a notable power of absorbing phosphoric acid from the solutions of its salts, and, to a much smaller extent, a capacity for taking up sulphuric, hydrochloric, and nitric acid—at least if these acids are presented in the form of ammonium salts—and that in all these cases the product of the absorption is a highly basic compound of the acid with the metallic oxide. It appears further that these metallic hydrates are also capable of absorbing bases, with which they either combine directly, or form highly basic double salts with acids either previously or at the same time absorbed. The hydrates are however incapable when alone of effecting any considerable absorption from a chloride or nitrate, although in the soil they probably absorb bases from these salts without difficulty, owing to the decomposing action of the lime of soils.

II. The hydrated double silicates contained in soil also exercise a very considerable absorptive power, which is confined to bases. The hydrated silicate of aluminium and calcium is capable of absorbing potash or ammonia from all the salts of these bases, and probably with nearly equal energy from each. The product in each case is a new hydrated double silicate, in which the calcium is more or less perfectly replaced by potassium or ammonium—the calcium thus displaced combining with the acid of the potassium or ammonium salt.

III. The humus contained in soil appears also to be capable of forming to some extent insoluble compounds with bases.

IV. Some of the calcium salts contained in soil, probably the carbonate, the silicate, and compounds of lime with ferric oxide and alumina, assist in several ways the operation of soil-absorption. By combining with the acids of certain salts, as carbonates, sulphates, chlorides, nitrates, they allow the bases of these salts to unite with the hydrated metallic oxides. The carbonate of calcium also converts the soluble acid phosphates applied in manure into sparingly soluble calcic phosphates, which, as they enter into solution, are finally converted into ferric and aluminic phosphates, as already described.

V. Lastly, besides these chemical actions of the ingredients of soil, several of the component parts of soil possess the power of attracting to their surface certain organic and sparingly soluble compounds, by virtue of simple physical adhesion. This power is apparently possessed by clay, by the hydrated metallic oxides, and possibly by humus. To the existence of this power the decolorizing and clarifying properties of soil are due.

The absorptive power of soil does not therefore reside in a single ingredient, nor is it to be attributed to a single action. Soils of very various character and composition may equally enjoy this important property. With clay soils the silicates and alumina will chiefly sustain the action; with loams and sandy soils the ferric oxide will play an important part; with pasture soil the action of the humus rises in significance. It is not to be supposed, however, that absorption in all these cases amounts to the same thing. The compound of a base with a silicate, with a metallic hydrate, and with humus, must in every case possess distinct properties, will probably resist in a different degree the solvent action of water, and be variously affected by other chemical agents. The difference to the plant between these different compounds may possibly be considerable. The relation of both the quantity and kind of the absorptive power of a soil to its fertility, and the influence of cultivation upon both aspects of this property of soil, is I believe a subject yet untouched, and can perhaps hardly yet be attempted until more perfect investigations have been made upon the elementary parts of this great question. These, we need scarcely say, are grievously needed. When will the country, that owes so much to agriculture, and depends so greatly upon its successful pursuit for prosperity, perceive the importance of directly furthering such objects? Germany has its forty-five experimental stations, supported by the respective Governments; these establishments being devoted to the scientific study of agricultural questions. England, to the honour of individual effort, possesses one station—that at Rothamsted[1]—which all admire, but none have imitated. The agricultural societies of this country, and the college at Cirencester, have also done good work; but for the task before them these institutions are, both singly and collectively, inadequate. Until, in fact, the prosecution of agricultural science is acknowledged as an object worthy of national exertion, the thorough investigations which the subject demands can hardly be expected.

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[1] However important the researches at Rothamsted may be, in considering the services rendered to agriculture by agricultural chemists, the valuable work of Way, Voelcker, and Anderson must not be overlooked.—*Ed.*

EXPERIMENTS ON GRASSES AND CLOVERS.

1867-68.

BY

JOHN WRIGHTSON, M.R.A.C., F.C.S.,

PROFESSOR OF AGRICULTURE IN THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

EXPERIMENTS ON GRASSES AND CLOVERS.

Experiments upon the effect of various manures applied to cultivated grasses and clovers have been carried out during the past two years upon the College Experimental Farm. Discouraging, and in some respects contradictory, as the results may at first sight appear, they yet seem to warrant the two or three practical conclusions that have been hazarded at the close of this paper.

In 1867 equal price per acre was the standard of comparison used between the various manures, and in 1868 the same weights were applied as in the previous season, notwithstanding any variation in market value which they might have undergone in the interim. The experiments were conducted upon a calcareous clay, resting on the Forest Marble. In the first season the manures were applied—(1.) To an ordinary mixture of clovers and ryegrass; and (2.) to a mixture of clovers alone. In the second season the same fertilizers were applied to similar land sown with (1.) Mixed clovers and ryegrass; and (2.) Red clover alone. The selected manures were distributed over each of the crops just mentioned, thus forming two parallel series of plots. The object of this method was to test the effect of any given manure, not only upon an ordinary mixture of seeds, but also upon clover, so as to settle a somewhat difficult question, namely, that, granted a manure (such as nitrate of soda) is beneficial to a general crop of seeds, does it act by stimulating the clovers or the ryegrass? Or, may it not, while stimulating the growth of the ryegrass, possibly act even prejudicially upon the clover? Further, each plot was repeated, so that the imperfect evidence given by one trial might be confirmed or set aside by a second. Too much importance can hardly be attached to this consideration in carrying out agricultural experiments, because the value of any result in which duplicate plots are not used, must be exceedingly small. The record of two plots placed under similar treatment frequently gives rise to apparent contradictions, which, although disappointing to the experimenter, should not be disregarded, but carefully studied.

EXPERIMENTS IN 1867.

Plots of $\frac{1}{20}$ acre each were staked off, and four plots were assigned to each manure, two being of clover alone, and two of mixed "seeds." The following is a list of the plots, and the manures applied to them:—

Mixed Clover and Ryegrass (Seeds).

Plot 1. 14 lbs. nitrate of soda.
,, 2. 14 ,, sulphate of ammonia.
,, 3. 10 ,, sulphate of potash.
,, 4. 32 ,, mineral superphosphate (Lawes').
,, 5. 14 ,, nitrate of soda.
,, 6. Unmanured.
,, 7. 14 lbs. sulphate of ammonia.
,, 8. 32 ,, mineral superphosphate (Lawes').
,, 9. Unmanured.
,, 10. 10 lbs. of sulphate of potash.

Mixed Clover Plots.

Plot 11. 10 lbs. of sulphate of potash.
,, 12. Unmanured.
,, 13. 14 lbs. of nitrate of soda.

Plot 14. 10 lbs. of sulphate of potash.
„ 15. 32 „ mineral superphosphate (Lawes').
„ 16. 14 „ of nitrate of soda.
„ 17. 14 „ sulphate of ammonia.
„ 18. Unmanured.
„ 19. 32 lbs. mineral superphosphate (Lawes').
„ 20. 14 „ sulphate of ammonia.

The severity of the March of 1867 precluded the possibility of sowing these manures until from the 3d to the 6th of April, when the work was satisfactorily accomplished.

The clover plant was not so uniform as could have been desired, by reason of the somewhat capricious growth of the red clover (*Trifolium pratense*). Plots 12, 13, and 19 bore the most even plant, and were therefore selected respectively for superphosphate of lime, nitrate of soda, and an unmanured portion. The remaining plots were well covered with trefoil (*Medicago Lupulina*), and Alsike and white clovers. The mixed clovers and ryegrass plots presented a much more uniform appearance, and may be described as possessing a good plant of grass, with a somewhat deficient braid of clover. A few days after the distribution of the nitrate of soda and sulphate of ammonia, the grass plots to which they had been applied began to be conspicuous by their verdure, and later the colour of the nitrate of soda clover plots indicated similar vigour.

This effect of nitrate of soda upon clover was most interesting, and was sufficiently marked to be visible at a considerable distance. The effect certainly was partially due to an increase of miscellaneous herbage, but there could be no doubt as to the superior vigour of the clover plant.

The crop was cut on the 17th, 18th, and 19th of June, and was carted on the 26th of the same month, the weather being dry during the whole of the time. The grass or clover was cut with the scythe, gathered into cocks in the centre of each plot, and weighed first when green, immediately after cutting, and again just before carting to the stack. Experience showed that there were difficulties attending the weighing of clover when dry, as it involved loss of leaf, and consequently of weight. It was thus considered both a source of error and of injury to the clover hay,—and was not persisted in the second season.

To make the results obtained during the two years as far as possible comparable, the amount of hay was, in both cases, calculated upon bases obtained by weighing the hay the first season. These data were confirmed by weighing two plots of clover and four of ryegrass, as hay, in 1868. A few remarks upon the proportion of hay to grass or clover will be found at the close of this paper.

The produce per plot and per acre in both series is given in Tables I. and II. The effect of the nitrogenous manures is shown by a considerable increase wherever they have been applied, either to clover or mixed seeds.

This is the more apparent when Table III. is consulted, where the $\frac{1}{20}$ acre plots are added together, and the results are given as those of plots of $\frac{1}{10}$ acre each; and where, consequently, average results are obtained in place of direct testimony from each plot. This table shows, that, according to these experiments, nitrogenous manures exercised a beneficial influence upon clover, although on comparing the increase with that obtained by applying the same manures to mixed seeds the effect will be seen to have been less marked. Table IV. will enable the reader at a glance to compare the relative effects of the two classes of manures on the crops to which they were applied :—

TABLE I.—RESULT OF EXPERIMENTS on the Growth of MIXED CLOVERS and RYEGRASS, 1867.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN GRASS.								PRODUCE IN HAY, calculated at 35 per cent. of the Weight of Grass.								INCREASE over Unmanured Portion.			
				Per Plot.				Per Acre.				Per Plot.				Per Acre.				Per Acre.			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
1	Nitrate of Soda,	14	April 3,	0	9	2	22	9	13	3	20	0	3	1	16	3	7	3	12	1	0	3	26
2	Sulphate of Ammonia,	14	,,	0	10	2	14	10	12	2	0	0	3	2	24	3	14	1	4	1	7	1	18
3	Sulphate of Potash,	10	,,	0	8	0	13	8	2	1	8	0	2	3	10	2	16	3	4	0	9	3	18
4	Mineral Superphosph. (Lawes'),	32	,,	0	7	3	6	7	16	0	8	0	2	2	26	2	14	2	14	0	7	3	2
5	Nitrate of Soda,	14	,,	0	8	0	23	8	4	0	12	0	2	3	13	2	17	1	8	0	10	1	22
6	Unmanured,	..	,,	0	6	1	7	6	6	1	0	0	2	0	23	2	4	0	21		..	..	
7	Sulphate of Ammonia,	14	,,	0	8	3	7	8	16	1	0	0	3	0	9	3	1	2	21	0	14	2	26
8	Mineral Superphosph. (Lawes'),	32	,,	0	7	3	10	7	16	3	4	0	2	2	27	2	14	3	8	0	7	3	22
9	Unmanured,	..	,,	0	7	0	12	7	2	0	16	0	2	1	26	2	9	2	16		..	..	
10	Sulphate of Potash,	10	,	0	6	2	15	6	12	2	20	0	2	1	8	2	6	1	21	0	0	1	22
																				(Decrease.)			
																2	6	3	14=	Average of Non-manured Plots.			

TABLE II.—RESULT OF EXPERIMENTS on the Growth of MIXED CLOVERS, 1867.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN CLOVER.								PRODUCE IN HAY, calculated at 25 per cent. of Clover.								INCREASE over Unmanured Portion.			
				Per Plot.				Per Acre.				Per Plot.				Per Acre.				Per Acre.			
		lbs.		tons	cwts.	qrs.	lbs.	tons	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
11	Sulphate of Potash,	10	April 3,	0	6	3	0	6	15	0	0	0	1	2	21	1	13	3	0	0	5	2	24
12	Unmanured,	..	,	0	5	3	27	5	19	3	8	0	1	2	0	1	10	0	0		..	..	
13	Nitrate of Soda,	14		0	8	1	6	8	6	0	8	0	2	0	8½	2	1	1	20	0	13	0	26
14	Sulphate of Potash,	10	,,	0	6	2	23	6	14	0	12	0	1	2	20	1	13	2	8	0	5	2	4
15	Mineral Superphosph. (Lawes'),	32	,,	0	5	3	26	5	19	2	16	0	1	1	27½	1	9	3	18	0	1	3	14
16	Nitrate of Soda,	14		0	7	0	18	7	3	0	24	0	1	3	4½	1	15	3	6	0	7	3	2
17	Sulphate of Ammonia,	14	,	0	6	1	25	6	9	1	24	0	1	2	13	1	12	1	13	0	4	1	9
18	Unmanured,	..	,,	0	5	0	24	5	4	1	4	0	1	1	6	1	6	0	8		..	..	
19	Mineral Superphosph. (Lawes'),	32	,,	0	7	2	22	7	13	3	20	0	1	3	19½	1	18	1	26	0	10	1	22
20	Sulphate of Ammonia,	14	,	0	6	2	20	6	13	2	8	0	1	2	19	1	13	1	16	0	5	1	12
																1	8	0	4=	Average of Unmanured Plots.			

TABLE III.—SHOWING THE RESULTS OF THE EXPERIMENTS when the Duplicate Plots were added together, so as to represent Plots of $\frac{1}{10}$ Acre each.

MIXED CLOVER AND RYEGRASS PLOTS, 1867.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN GRASS.								PRODUCE IN HAY, calculated as before.								INCREASE over Unmanured Portion.			
				Per Plot.				Per Acre.				Per Plot.				Per Acre.				Per Acre.			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
	Nitrate of Soda,	28	April 3,	0	17	3	17	8	19	0	2	0	6	1	1	3	2	2	10	0	15	2	24
	Sulphate of Ammonia, .	28	,,	0	19	1	21	9	14	1	14	0	6	3	5	3	7	3	22	1	1	0	8
	Sulphate of Potash, .	20	,,	0	14	3	0	7	7	2	2	0	5	0	18	2	11	2	12	0	4	2	26
	Superphosphate, . .	64	,,	0	15	2	16	7	16	1	20	0	5	1	25	2	14	3	0	0	7	3	12
	Unmanured, . .		,,	0	13	1	19	6	14	0	22	0	4	2	22	2	6	3	14		..	..	

MIXED CLOVER ALONE, 1867.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN GRASS.								PRODUCE IN HAY, calculated as before.								INCREASE over Unmanured Portion.			
		lbs.																					
	Nitrate of Soda, . .	28	April 3,	0	15	1	24	7	14	2	16	0	3	3	13	1	18	2	13	0	10	2	9
	Sulphate of Ammonia, .	28	,,	0	13	0	17	6	11	2	2	0	3	1	5	1	12	3	22	0	4	3	18
	Sulphate of Potash, .	20	,,	0	13	1	23	6	14	2	6	0	3	1	13	1	13	2	18	0	5	2	14
	Superphosphate,	64	,,	0	13	2	20	6	16	3	4	0	3	1	19	1	14	0	22	0	6	0	18
	Unmanured, .	..	,,	0	11	0	23	5	12	0	6	0	2	3	6	1	8	0	4		..	..	

TABLE IV.

MANURE USED.	MIXED CLOVERS AND RYEGRASS.			MIXED CLOVERS.		
	Increase in Hay per Acre over Unmanured Plot.			Increase in Hay per Acre over Unmanured Plot.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
Nitrate of Soda, . .	15	2	24	10	2	9
Sulphate of Ammonia,	21	0	8	4	3	18
Sulphate of Potash, .	4	2	26	5	2	14
Superphosphate (Lawes'),	7	3	12	6	0	18

If these tables are examined with reference to the effect of the mineral manures, it will be seen that sulphate of potash caused a considerable increase in the yield of one *grass* plot, but was without effect in the case of the other. On *clover*, both plots treated with this substance gave a satisfactory increase.

The application of Lawes' Mineral Superphosphate to mixed seeds (grass) was attended with good effects on both plots to which it was applied. The clover results were not so satisfactory; one plot yielding a large increase, while the duplicate gave a crop of about the same weight as the average of the two unmanured portions.

The average results obtained in each series are shown in Table IV. It will there be seen that both crops were benefited by the mineral manures; the clover on the whole deriving the greatest benefit from the sulphate of potash, while the mixed seeds gave a result favourable to superphosphate.

We must bear in mind that although the increase per acre in the case of both crops is not altogether dissimilar, the effect of the mineral manures upon clover was more considerable, for the increase was upon a yield of about 35 cwts. of hay per acre, while the increase upon the mixed seeds was upon a crop of above 50 cwts. per acre. We have therefore little hesitation in saying that in this case the mineral manures produced a more considerable effect on clover than on the mixed seeds.

This statement does not touch the question as to the policy of applying superphosphate or sulphate of potash to clover; because although the relative effect of such manures was greater in the case of the clover crop than in the case of the mixed seeds, the largest increase in both crops was obtained by the use of a nitrogenous manure, and especially by the use of nitrate of soda. One fact stands out prominently in the results, as shown in the accompanying tables, and it is one of some importance to the practical farmer: in scarcely any case does the application of a top-dressing to clover appear to have been followed by an adequate return; or, in other words, the increase in crop was purchased at too high a rate. The application of certain dressings to mixed seeds contrasts favourably in this respect, and shows a fair profit.

It has been stated that the clover plots 12, 13, and 19 were the most regular in plant, and that they were for that reason selected as the most fit positions for comparing nitrate of soda and "superphosphate" with an unmanured space. The result showed a most satisfactory increase from the use of both substances, but larger by nearly 3 cwts. in the case of the nitrate of soda.

EXPERIMENTS ON THE GROWTH OF CLOVER AND RYEGRASS, 1868.

The experiments of 1867 were repeated the following year, with the addition of plots manured with gypsum, and others with a mixture of superphosphate of lime and sulphate of ammonia. One plot in each series was also dressed with Proctor's Bone Superphosphate in the spring. The importance of autumn dressing in the case of mineral manures having been insisted upon by a high authority, these substances were applied to their respective plots on the 21st and 25th of November, and the nitrate of soda and Proctor's Superphosphate were distributed on February 24th and March 7th. A list of the manures used is appended :—

Red-Clover Plots.

Plot	1.	Lawes' Mineral Superphosphate, .	32	lbs.
„	2.	Sulphate of potash, . . .	32	„
„	3.	Sulphate of ammonia, . . .	14	„
„	4.	Unmanured.		
„	5.	Nitrate of soda, ...	14	„
„	6.	Lawes' Mineral Superphosphate, 16 lbs. ; sulphate of ammonia, 7 lbs.	23	„
„	7.	Lawes' Mineral Superphosphate, .	32	„
„	8.	Sulphate of potash, . . .	10	„
„	9.	Sulphate of ammonia, . . .	14	„
„	10.	Unmanured.		
„	11.	Proctor's Superphosphate, . .	24	„
„	12.	Gypsum, ...	56	„
„	13.	Lawes' Mineral Superphosphate, 16 lbs. ; and sulphate of ammonia, 7 lbs., ...	23	„
„	14.	Nitrate of soda, ...	14	„
„	15.	Gypsum, . . .	28	„

Mixed Seed Plots.

Plot	16.	Sulphate of ammonia, . .	14	lbs.
„	17.	Sulphate of potash, . . .	10	„
„	18.	Lawes' Mineral Superphosphate, .	32	„
„	19.	Unmanured.		
„	20.	Nitrate of soda, ...	14	„
„	21.	Gypsum, ...	56	„
„	22.	Lawes' Mineral Superphosphate, .	32	„
„	23.	Sulphate of potash, . . .	10	„
„	24.	Sulphate of ammonia, . .	14	„
„	25.	Unmanured.		

Plot 26.	Lawes' Mineral Superphosphate, 16 lbs.; and sulphate of ammonia, 7 lbs.,	23 lbs.
„ 27.	Proctor's Superphosphate,	24 „
„ 28.	Gypsum,	28 „
„ 29.	Nitrate of soda,	14 „
„ 30.	Lawes' Mineral Superphosphate, 16 lbs.; and sulphate of ammonia, 7 lbs.,	23 „

The same general plan was followed in carrying out these trials as in 1867, but the two crops experimented upon in the latter season consisted—(1.) of pure red clover (*Trifolium pratense*); and (2.) of mixed clovers and ryegrass as before. The early spring was favourable to the development of these crops, though the effects of the famous drought of that year began to be felt before hay time. The foregoing remarks show that the conditions of this experiment were not strictly comparable with those of 1867; and when we remember the different characters of the two seasons, this may serve to explain some inconsistencies in the results obtained.

The crop was cut on June 8th and 9th, and was secured without a shower. With reference to the clover plots, it is worthy of remark, that immediately before cutting they presented a very uniform appearance. No change of colour, and little or no difference in height or vigour, pointed out the peculiar action of any fertilizer used. All were level, luxuriant, and excellent. The produce of each plot was only weighed as grass, for reasons already stated (page 130), and the amount of hay was calculated upon data obtained last season.

Mixed Seeds Results.

On examining the "mixed seeds" results (Table V. p. 139), it will be seen, as might have been expected, that the nitrate of soda in the case of both plots to which it was applied gave a good increase. A corresponding effect from the use of sulphate of ammonia was looked for in vain, this substance only yielding a comparatively small return. Last year both of these nitrogenous manures were applied in the spring, and gave excellent results. This season the first, applied in the spring, was again satisfactory; the second, sown in the autumn, only gave a trifling increase. Superphosphate, derived from a mineral source, was not successful in producing an increase of crop, but when mixed with sulphate of ammonia it yielded a considerable return. Proctor's Superphosphate, manufactured from bones, also yielded a large increase. The gypsum results were too discordant to be of any practical use.

Last season the evidence respecting sulphate of potash as a dressing for mixed seeds was conflicting. This year the verdict was decidedly against its use, as in both cases where it was applied the crop, so far from being improved, was apparently injured.

Red Clover Results.

The effects of the substances used as fertilizers in the case of red clover differed in many points from those obtained last year. The reader, upon examining the tabulated results (see Table VI. p. 140), will no doubt be struck with the injury which many of the manures seem to have inflicted. This is probably more apparent than real. It may be looked upon as a further proof of what was stated in recording similar experiments last year, namely, that clover is not influenced by the application of many of those substances used with such good effects upon other cultivated plants. Here we find an unmanured plot producing a better crop than any of the others, with the exception of that dressed with Proctor's Bone Superphosphate.

The duplicate unmanured plot also stands high in the scale. Next we find sulphate of ammonia and nitrate of soda placed respectively on either side of an unmanured plot, and yielding a worse return, while their duplicates (Series II., Table VI.), in near proximity to a second unmanured plot, confirm the lesson taught by the first. The presence of sulphate of ammonia mixed with superphosphate, as in plots 6 and 13, will also be seen to have, upon the whole, lowered the yield of hay below that given by the superphosphate plots. This is seen in Table VII. p. 141, where the average results of the two plots taken together is given.

Proctor's Superphosphate stands out prominently as the best manure for clover, according to the results of this year. The mineral superphosphate gives in one case an increase (Series I., Table VI.), under circumstances where this fact renders it peculiar. The duplicate plot does not, however, confirm its usefulness. Generally, with reference to superphosphates, it is worthy of observation, that out of the three plots to which they were applied, two yielded satisfactory results, while no other manure with which they were compared exerted any beneficial influence at all. This fact agrees with the remarks made in the report of similar experiments carried out in 1867.

Sulphate of potash gave no result except of a negative character, its application in both cases having been attended by a considerable reduction in the yield of clover.

TABLE V.—RESULTS OF EXPERIMENTS on MIXED CLOVERS and RYEGRASS.—SERIES I., 1868.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE OF GRASS.								PRODUCE IN HAY, calculated at 35 per cent. of Weight of Grass.								INCREASE OVER Unmanured.				DECREASE below Unmanured.			
				Per Plot.				*Per Acre.*				*Per Plot.*				*Per Acre.*				*Per Acre.*				*Per Acre.*			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
16	Sulphate of Ammonia,	14	Nov. 21,	0	6	3	3	6	15	2	4	0	2	1	13	2	7	1	8	0	0	2	24		..	..	
17	Sulphate of Potash, . .	10	,, 21,	0	5	2	25	5	14	1	24	0	2	0	0	2	0	0	0		..	..		0	6	2	12
18	Miner. Superphos. (Lawes')	32	,, 21,	0	6	1	7	6	6	1	0	0	2	0	23	2	4	0	12		..	..		0	2	2	0
19	Unmanured, .	..	....	0	6	2	19	6	13	1	16	0	2	1	9	2	6	2	12		..	.					
20	Nitrate of Soda, .	14	Feb. 24,	0	7	2	9	7	11	2	12	0	2	2	17	2	13	0	4	0	6	1	20		.	..	
21	Gypsum, ...	56	Nov. 25,	0	6	0	26	6	4	2	16	0	2	0	20	2	3	2	8		..			0	3	0	4
22	Miner. Superphos. (Lawes')	32	,, 21,	0	6	0	11	6	1	3	24	0	2	0	15	2	2	2	21		..	..		0	3	3	20

SERIES II.

No. of Plot.		Weight of Manure Applied.	Date of Application.	Grass Per Plot tons.	cwts.	qrs.	lbs.	Grass Per Acre tons.	cwts.	qrs.	lbs.	Hay Per Plot tons.	cwts.	qrs.	lbs.	Hay Per Acre tons.	cwts.	qrs.	lbs.	Increase Per Acre tons.	cwts.	qrs.	lbs.	Decrease Per Acre tons.	cwts.	qrs.	lbs.
23	Sulphate of Potash, .	10	Nov. 21,	0	5	2	13	5	12	1	8	0	1	3	24	1	19	1	4		..	.		0	0	1	22
24	Sulphate of Ammonia,	14	,, 21,	0	6	2	3	6	10	2	4	0	2	1	3	2	5	2	4	0	5	3	6			..	
25	Unmanured, ...	..	....	0	5	2	19½	5	13	1	26	0	1	3	26	1	19	2	24		..	.				..	
26	Miner. Superphos., 14 lbs. Sulphate of Ammonia, 7 ,,	21	Nov. 25,	0	6	2	13	6	12	1	8	0	2	1	7	2	6	1	0	0	6	2	2			..	
27	Proctor's Superphosphate,	24	Mar. 7,	0	7	1	18½	7	8	1	6	0	2	2	11	2	11	3	24	0	12	0	26		..	..	
28	Gypsum, . .	28	Nov. 25,	0	6	3	12	6	17	0	16	0	2	1	16	2	7	3	12	0	8	0	14		..	..	
29	Nitrate of Soda, . .	14	Feb. 24,	0	8	0	8	8	1	1	20	0	2	3	8	2	16	1	20	0	16	2	22			..	
30	Miner. Superphos., 14 lbs. Sulphate of Ammonia, 7 ,,	21	Nov. 25,	0	6	3	26½	6	19	2	26	0	2	1	22	2	8	3	20	0	9	0	22			..	

TABLE VI.—RESULT OF EXPERIMENTS upon the Growth of RED CLOVER (*Trifolium pratense*).

SERIES I., 1868.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN CLOVER.								PRODUCE IN HAY, calculated at 25 per cent. the Weight of Clover.								INCREASE over Unmanured.				DECREASE below Unmanured.			
		Per Plot.		*Per Plot.*				*Per Acre.*				*Per Plot.*				*Per Acre.*				*Per Acre.*				*Per Acre.*			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
1	Mineral Superphosphate,	32	Nov. 21,	0	7	0	6	7	1	0	8	0	1	3	1½	1	15	1	2	0	1	1	0		..	..	
2	Sulphate of Potash,	10	....	0	6	0	0	6	0	0	0	0	1	2	0	1	10	0	0			..		0	4	0	2
3	Sulphate of Ammonia, .	14	....	0	5	1	25	5	9	1	24	0	1	1	13	1	7	1	8			..		0	6	3	4
4	Unmanured, . .	..	....	0	6	3	6	6	16	0	8	0	1	2	22½	1	14	0	2		.	..			..	..	
5	Nitrate of Soda, . .	14	Feb. 24,	0	6	0	0	6	0	0	0	0	1	2	0	1	10	0	0		..	..		0	4	0	2
6	{ Miner. Superphos ,16 lbs. { Sulphate of Ammonia, 7 ,,	} 23	Nov. 25,	0	6	1	22	6	8	3	24	0	1	2	12½	1	12	0	27			..		0	1	3	4

SERIES II.

No. of Plot.		Weight of Manure Applied.	Date of Application.	PRODUCE IN CLOVER.								PRODUCE IN HAY, calculated at 25 per cent. the Weight of Clover.								INCREASE over Unmanured.				DECREASE below Unmanured.			
		Per Plot.		*Per Plot.*				*Per Acre.*				*Per Plot.*				*Per Acre.*				*Per Acre.*				*Per Acre.*			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
7	Mineral Superphosphate,	32	Nov. 21,	0	7	1	22	7	8	3	24	0	1	3	12½	1	17	0	27	(0	3	0	14) (Compared with P. 4.)	0	3	1	26
8	Sulphate of Potash,	10	....	0	7	0	6	7	1	0	8	0	1	3	1½	1	15	1	2					0	5	1	22
9	Sulphate of Ammonia, .	14	....	0	7	1	21	7	8	3	0	0	1	3	12¼	1	17	0	21			..		0	3	2	3
10	Unmanured, . .	..	....	0	8	0	17½	8	3	0	14	0	2	0	4	2	0	2	24		.	..			..	..	
11	Proctor's Superphosphate,	24	Mar. 7,	0	8	3	16	8	17	3	12	0	2	0	25	2	4	1	24	0	3	3	0		..	..	
12	Gypsum, . . .	56	Nov. 25,	0	7	2	0	7	10	0	0	0	1	3	14	1	17	2	0		..	..		0	3	0	24
13	{ Miner. Superphos.,16 lbs. { Sulphate of Ammonia, 7 ,,	} 23	....	0	7	3	5½	7	15	3	26	0	1	3	22½	1	18	3	27½			..		0	1	2	22
14	Nitrate of Soda, .	14	Feb. 24,	0	7	2	3	7	10	2	4	0	1	3	15	1	17	2	20		.	..		0	3	0	4
15	Gypsum, . . .	28	Nov. 25,	0	7	1	25	7	9	1	24	0	1	3	13	1	17	1	8		.	..		0	3	1	16

TABLE VII.—SHOWING RESULTS when the Duplicate Plots are added together, so as to represent Plots of $\frac{1}{10}$ Acre each.

MIXED CLOVERS AND RYEGRASS PLOTS, 1868.

No. of Plots.		Weight of Manure Applied.	Date of Application.	Produce in Grass.								Produce in Hay.								Increase.				Decrease.			
				Per Plot.				Per Acre.				Per Plot.				Per Acre.				Per Acre.				Per Acre.			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
20 & 29	Nitrate of Soda,	28	Feb. 24,	0	15	2	17	7	16	2	2	0	5	1	25	2	14	2	26	0	11	2	12		..	..	
16 & 24	Sulphate of Ammonia,	28	Nov. 21,	0	13	1	6	6	13	0	4	0	4	2	16	2	6	1	20	0	3	1	6		..	..	
17 & 23	Sulphate of Potash,	20	Nov. 21,	0	11	1	10	5	13	1	16	0	3	3	24	1	19	2	16		..	..		0	3	1	24
18 & 22	Miner. Superphos. (Lawes')	64	Nov. 21,	0	12	1	18	6	4	0	12	0	4	1	10	2	3	1	16	0	0	1	2		..	..	
27	Superphosphate (Proctor's)	48	Mar. 7,	0	14	3	9	7	8	1	6	0	5	0	21	2	11	3	24	0	8	3	10		..	..	
26 & 30	Min. Superphos., 32 lbs., Sulp. of Ammonia, 14 ,,	46	Nov. 21,	0	13	2	11½	6	16	0	3	0	4	3	1	2	7	2	10	0	4	1	24		..	..	
19 & 25	Unmanured,	..	....	0	12	1	10½	6	3	1	22	0	4	1	7	2	3	0	14		..	..			..	..	

RED CLOVER PLOTS, 1868.

No. of Plots.		Weight of Manure Applied.	Date of Application.	Produce in Grass.								Produce in Hay.								Increase.				Decrease.			
				Per Plot.				Per Acre.				Per Plot.				Per Acre.				Per Acre.				Per Acre.			
		lbs.		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
5 & 14	Nitrate of Soda,	28	Feb. 24,	0	13	2	3	6	15	1	2	0	3	1	15	1	13	3	10		..	..		0	3	2	3
3 & 9	Sulphate of Ammonia,	28	Nov. 21,	0	12	3	18	6	9	0	12	0	3	0	25	1	12	0	26		..	..		0	5	0	15
2 & 8	Sulphate of Potash,	20	Nov. 21,	0	13	0	6	6	10	2	4	0	3	1	1½	1	12	2	15		..			0	4	2	26
1 & 7	Miner. Superphos. (Lawes')	64	Nov. 21,	0	14	2	0	7	5	2	0	0	3	2	14	1	16	1	0		..	..		0	1	0	18
11	Superphosphate (Proctor's)	48	Mar. 7,	0	17	3	4	8	17	3	12	0	4	1	22	2	4	1	24	0	8	0	11			..	
6 & 13	Mineral Superphosphate, Sulphate of Ammonia,	46	Nov. 21,	0	14	0	27½	7	2	1	25	0	3	2	7	1	15	2	14			..		0	1	2	27
4 & 10	Unmanured,	..	....	0	14	3	23½	7	9	2	11	0	3	2	27	1	17	1	18			..			..	..	

Such are the points of interest which appear to be brought out in the above-described experiments. In conclusion, it will be advisable to gather together the practical results in which the experiments of the two seasons corroborate each other.

1*st.* The growth of clover was not greatly influenced by any of the fertilizers used.

2*d.* The effect of the two nitrogenous manures applied to clover is exceedingly perplexing. The first year a moderate increase was obtained from their use, while in the second season their application appears to have been followed with negative or injurious results.

3*d.* Sulphate of potash cannot be recommended as a dressing for mixed seeds. When used as a manure for clover, a fair and uniform increase of crop was obtained the first season, but this result was not confirmed by later experiments. Practically, it may be stated that in neither season did any plot to which this substance was applied yield a result which would warrant its extended use.

4*th.* Further trials of superphosphate of lime, and especially of bone superphosphates, may be pointed out as worthy of the attention of the farmer.

5*th.* In the case of mixed seeds, nitrate of soda, and sulphate of ammonia applied in the spring have given the best results.

6*th.* The action of nitrate of soda and sulphate of ammonia on both crops experimented upon in 1868 was striking. When applied alone, or in combination with superphosphate, to mixed seeds, they invariably increased the crop. On the other hand, when applied alone, or in combination with superphosphate to clover, a directly opposite effect was produced.

NOTE ON THE PROPORTION OF HAY TO GRASS.

During the first season of the experiments just described the produce of each plot was weighed first when green, and afterwards as hay. A fair idea was thus gained as to the percentages of both red clover and mixed seed-hay to the green produce from which it was derived. Reference to the accompanying table will show that there was a considerable difference in this particular between these two crops.

The clover yielded in 1867 an average of 24 per cent. of hay, weighed when in good order, immediately before stacking; and in 1868 the clover, from two plots weighed under similar circumstances, gave respectively 25·7 and 26·4 per cent. of hay. The mixed seeds yielded a much larger relative amount of hay, the average being in 1867 as high as 32 per cent., while the average of four plots weighed in the succeeding year yielded 35·6 per cent. Mr. Swanwick, of the College Farm, Cirencester, published in the *Transactions of the Highland and Agricultural Society for* 1868 some experiments upon grass and clover, carried out during the year 1865, on Mr. Hope's farm at Fentonbarns, Scotland. In these experiments the produce of a large number of plots was weighed both as grass and as hay, and the results showed an average of 33 per cent. of hay in the case of four plots manured with guano, of 33·7 per cent. in four plots manured with sulphate of ammonia, and of 33 per cent. in the case of four unmanured plots. The grasses proper, therefore, according to these results, yield a larger proportion of hay than clover. In making this generalization it will be well to bear in mind the different stage of growth of the two crops; ryegrass being cut in a more matured condition than clover, it follows that the amount of solid matter is greater. Clover, on the other hand, has not usually arrived at that stage of development in which the maximum amount of solid matter might be expected to be present. The result of experiments upon town sewage, as applied to the growth of ryegrass, show the wide limits within which, under certain circumstances, the proportion of hay to grass may vary. We know, for instance, that while 100 tons of unsewaged grass produced 29 tons of hay, the same quantity of sewaged grass yielded only 22·2 tons,—a fact which shows us that immense crops of fresh grass produced by sewage application are decidedly inferior in quality to smaller crops grown under more ordinary conditions.

The effect of various manurial applications in increasing the relative proportion of hay to grass, is also seen by inspecting the results of the weighings made in 1867, the nitrogenous manures having given in almost all cases a larger percentage than the mineral manures. This fact is not necessarily a proof of an actually larger proportion of dry matter having been accumulated in the crop raised by such manures. It, in all probability, is due to the grass produced by the aid of nitrogenous applications retaining a larger quantity of water when made into hay than that grown by mineral substances. This remark is borne out by Messrs. Lawes and Gilbert, who analysed samples of hay from each plot of permanent pasture experimented upon at Rothamsted between the years 1856 and 1862. The general conclusion arrived at by these gentlemen was, that ammoniacal manure lowered the percentage of *dry matter* in meadow hay, and that mineral manure tended to increase it.—(Vol. xxiv. *R.A.S. Journal*, p. 519.) Again, quoting from an earlier report of the same experiments, we find the following passage :—" Ammoniacal salts, which have thus been seen, other things being equal, to give a produce which contains a comparatively low percentage of dry matter, gave, it should be remembered, also *a much increased bulk and weight of hay over a given area.*"—(*Ibid.* vol. xx. p. 402.) After accurate experiments, extending over seven years, Messrs. Lawes and Gilbert consider, that although these general conclusions with respect to the action of mineral and ammoniacal manures may be drawn, the proportion of hay to grass is influenced to a greater extent by other circumstances. Thus the stage of ripeness has a marked effect, the proportion of hay being greater as the plant approaches maturity. The dryness or wetness of the season also exerts considerable influence in raising or lowering the percentage of hay to fresh-cut grass.

TABLE showing the PERCENTAGE of HAY yielded by GREEN CLOVER and MIXED SEEDS.

MIXED SEEDS PLOTS.

	GREEN PRODUCE.				HAY.				Percentage of Hay to Green Produce.
	Per Plot.				*Per Plot.*				
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	
Nitrate of Soda,	0	9	2	22	0	3	0	25	33·2
Sulphate of Ammonia,	0	10	2	14	0	3	1	25	32·7
Sulphate of Potash,	0	8	0	13	0	2	1	16½	29·4
Superphosphate,	0	7	3	6	0	2	1	12½	30·3
Nitrate of Soda,	0	8	0	23	0	2	3	6	34·1
Unmanured,	0	6	1	7	0	2	0	6	32 5
Sulphate of Ammonia,	0	8	3	7	0	2	3	24	33·6
Superphosphate,	0	7	3	10	0	2	0	27	28·6
Unmanured,	0	7	0	12	0	2	0	20½	30·7
Sulphate of Potash,	0	6	2	15	0	2	0	20	32·8
									31·8 = Average.
MIXED CLOVER PLOTS.									
Sulphate of Potash,	0	6	3	0	0	1	2	3	22·6
Unmanured,	0	5	3	27	0	1	1	12	22 6
Nitrate of Soda,	0	8	1	6	0	1	3	18	23·0
Sulphate of Potash,	0	6	2	23	0	1	2	0	22.3
Superphosphate,	0	5	3	26	0	1	2	2	25·3
Nitrate of Soda,	0	7	0	18		..	..		..
Sulphate of Ammonia,	0	6	1	26	0	1	2	24½	26·5
Unmanured,	0	5	0	24	0	1	1	7½	25·3
Superphosphate,	0	7	2	22	0	1	8	3	23·0
Sulphate of Ammonia,	0	6	2	20	0	1	2	27	26·0
									24·0 = Average.

THE LAND QUESTION IN IRELAND ECONOMICALLY CONSIDERED.

BY

YNYR H. BURGES.

THE LAND QUESTION IN IRELAND

ECONOMICALLY CONSIDERED.

The question of greatest importance to the welfare of Ireland, second not even to the now engrossing question of the Church, is the state of the law between landlord and tenant. And on this subject there exists a great deal of misconception in England and Scotland, whilst in Ireland herself, one of the most important elements appears to a great measure to have escaped the attention of most of the writers and speakers who have made it their theme.

The chief reason for that cry against "exceptional legislation for Ireland," which arises from the English side of the Channel, is the idea that the Irish farmer and his landlord stand in the same relative positions as the English or Scottish farmers and their landlords. But the whole economy is different. In Ireland, the small farmer with his limited capital and, too frequently, a *very* limited amount of skill, has to make the improvements which across the Channel are carried out by the landlord, who has both capital and skill at his command. Nor is this all. The evil is further intensified as follows:—The skilled and moneyed landlord, in the one case, executes the improvements on land which is definitely settled on himself and his heirs, so that he has the utmost amount of security for his expenditure, while, in the other case, the individual who has to make the outlay—the poor and unskilled tenant—has generally to improve (if improve he does) without even the security of a lease ; so that whatever he lays out he runs the risk of losing at any time ; or even supposing that he and his heirs should continue to remain on the same farm, they are liable to having their rent raised on the foot of improvements made by themselves, before they have recouped themselves for their expenditure.

Of course it will be argued that this very seldom happens (we heard a case of the latter nature only yesterday), and that those landlords who thus deprive their tenants of their fair and legitimate rights are mere exceptions; but the existence of the bare possibility acts (and we say this from personal knowledge, not at random) as a chill upon agricultural confidence, and prevents many a tenant from making an outlay for his own benefit, and thus, indirectly, for the good of the country at large, which he would otherwise make readily and cheerfully.

It is true that in Ulster there is a custom of tenant-right, namely, the right of an outgoing tenant to sell his "good-will," as it is termed, to the incomer; and this, though not usually based on the actual improvements made, has virtually the effect of recouping the outgoer. But this custom, from not being legalized, is liable to many abuses, both of excess and of defect.

The remedy proposed by some of the extreme advocates of tenant-right in Ireland, while it would remove one branch of the evil at present existing, would tend to intensify the other. They propose that a tenant should be irremoveable by his landlord, save in the case of non-payment of rent; and that the outgoer should be permitted to sell his interest to the highest bidder. But the moral effect of this would be to give to many an uncultured and half-civilized small farmer such a feeling of independence of his landlord, that it would be almost hopeless for the latter, however well-meaning, to strive to improve the condition of his tenantry. *Security without skill* would be a far greater hindrance to advancement than *skill without security.*

We have known a case where the people threatened to shoot an agent who essayed to carry out a wholesale system of thorough drainage. He persisted, and succeeded; and the men afterwards blessed him when they saw the good effects which resulted. In this case he risked his life for their benefit: but were some such system as the above mentioned to become law, he would have had no legal right to enter their lands at all. We know of another instance in which a nine-acre farmer good-humouredly but flatly refused, even with a profitable inducement, to improve a house which was more like a pigstye than a human habitation. "It was good enough for my father and my grandfather," said he, "and it's good enough for me. I've a *lase with yer honour's own life in it,* and what do I want more?" As much as to say,—"I'm independent of you, and will be a savage if I choose!" The fact is, that *many of the advocates of tenant independence argue from a knowledge confined to a flourishing set of skilled farmers,* such as undoubtedly do exist in many parts of Ireland, but they ignore the condition of such men as we have alluded to, who unfortunately exist in multitudes in that country.

Want of skill is the main and fatal drawback under which these people labour. As for capital, so small are their holdings for the most part, that they and their families are capable of doing almost all that is needed for their improvement. All that is lacking is skilled guidance, and to this end it should be the aim of those who desire to promote the agricultural advancement of Ireland, to strive to unite landlord and tenant with closer ties of mutual interest, in place of driving them still further apart than (unfortunately) they now too frequently are.

One of the simplest methods, and perhaps the most effective, which has as yet been proposed, is that, in place of the present legal presumption that improvements which have become affixed to, or incorporated with, the soil, are the property of the landlord, the legal presumption should be, that they beloug to the tenant, in the absence of documentary evidence to the contrary; *i.e.*, that, lacking a written agreement, the tenant should also have a claim on the landlord, or on the succeeding tenant, for their value. This would tend to lead the landlord (who would naturally wish that his farms should not be burthened with the cost of imperfect or inefficient work) to make provision that he or his agent should be consulted in all cases of improvement (a thing which is now, we believe, too rarely done). Thus, skill and labour would be brought into connexion and co-operation, and the result would be, more commodious and sightly buildings, more skilfully constructed drains, and a better distribution of farm fences than it usually falls to our lot to behold in many parts of Ireland.

The tendency of the English or Scottish mind would be to propose that the landlord should make the improvements at his own cost, and charge the tenant a reasonable percentage; while, on the other hand, the Irish advocate of "tenant independence" would propose that the tenant should be allowed to do all himself with "no interference." But while the one method would entail (especially in the item of building) an expenditure which in many cases would be too heavy to be remunerative under the small farm system, the other would only tend to perpetuate clumsiness and mistakes.

We happen to have before us at this moment details illustrative of the three different views in question in the matter of building, namely, (1.) a group of cottages built by a landlord; (2.) a farm-house enlarged (through the addition of a storey) by a tenant; and (3.) a farm-house similarly enlarged by the combined outlay and skill of landlord and tenant. The group of cottages, three in number, containing in all, say twelve apartments, cost, exclusive of rear offices, £240, or at the average rate of £20 per apartment. These were built with a certain amount of consideration for the picturesque. The cost of workmanship of all kinds amounted in round numbers to £100, the balance of £140 being for material, or at the average rate of nearly £12 per apartment.

The material of the house enlarged by the tenant, "on his own hook," who, being a "bit of a handy man," could do a little of everything, and nothing too well, and did almost all the workmanship himself (building, slating, and carpentering), cost in round figures £20. This included the rebuilding of the two side walls from the ground, and then lofting the previous ground-floor rooms, and roofing with slates. He gained two new apartments hereby. The material for these would accordingly be under £10 per room (allowance being made for the rebuilding), but though this is lower than the average cost in the cottages aforesaid, it must be borne in mind that he dispensed with many matters of finish which added materially, if not to comfort, at any rate to comeliness, in that case. His real saving was in the workmanship, which he himself was able to do in the intervals of time which remained to him when his various field avocations were completed. But what sort of workmanship? Most praiseworthy were his exertions, as he worked "late and early" at his task; but when all was done, there remained a painful air of incompleteness and imperfection about the whole of it. It was not *totus teres atque rotundus.*

Now let us take the third case. Here skilled labour was employed under the superintendence of the tenant, and at his expense, the landlord contributing part of the material, and consulting and advising in the details. The cost of materials here was, in round numbers, £26, or about £9 per room (for there were three gained in the roof). The total cost of workmanship was £13. The side walls were raised six feet (thus gaining a clear second storey), the roof (formerly a thatched one) raftered and slated, and the upper windows and doorway picturesquely gabled. For an outlay in skilled workmanship exceeding by very little the value of the unskilled labour in the previous instance, lasting symmetry without and comfort within have here been insured. And be it observed that the material in this case came to about the same amount as that in the previous one, both being lower than that of the more ornate cottages, where mere paint and plaster, wood-staining and lattice-windows, swelled the total.

The real contrast in these three cases is the cost of workmanship in each. The landlord alone does the thing, we maintain, too dearly; he cannot get the same value for his money that the working tenant can. But the tenant alone, on the other hand, is too apt to err on the side of over-economy (which is, in fact, no economy), and to do the work too cheaply, clumsily, and unenduringly. It is on this account that we desire to urge the advantage, nay, the necessity, of landlord and tenant co-operation.

There is a real importance in the cultivation of taste. It has much to do with the advancement of the world in civilisation, and tends to engender that self-respect which leads in its turn to higher things. Were the landlord to contribute no more than this, it would be a great step gained. But more he *can* contribute. He can suggest many a comfort, almost unknown to a class as yet only in a moderately advanced stage of modern civilisation. It would be urged by some, that when the landlord had gone *thus* far, he could be expected to go no further. Irish landlords will sometimes tell us that the farms on their properties are so small, that it would "break them" to attempt to keep up the buildings on them after the English custom. But if they would only lay aside (as is done in the manufacturing world) five per cent. per annum of the rental for wear and tear of buildings, and expend this amount in aiding the efforts of their tenants, in addition to assisting them with counsel and advice, they will soon work a reformation which will surprise them. And here again we do not speak at random.

On the other hand, the work being done at the main cost of the tenant, and under his immediate superintendence, he gets it done far less expensively, to begin with, while in addition to this, he is able to barter horse and man-work (which he can spare from the intervals of his own field-labour), in return for the services of the artisans, who in most Irish country districts are themselves also holders of land. Thus we have a *creation* of capital which would otherwise be wasted.

In this union, therefore, between landlord and tenant, we find those elements, combining efficiency, economy, and skill, which tend to produce the most perfect and most desirable work, and to increase the profitable resources of a country.

And the same will be found to hold good in respect to other matters of permanent improvement on the farm, wherever the agricultural population is lacking in the necessary attributes of successful independence.

YNYR H. BURGES.

March 22, 1869.

THE GEOLOGICAL DISTRIBUTION OF TRICALCIC PHOSPHATE.

BY

W. T. THISELTON DYER, B.A.

WITH A PREFATORY NOTE BY A. H. CHURCH, M.A.

PREFATORY NOTE.

Of the various native phosphates which occur in the earth's crust, the tricalcic phosphate, commonly called phosphate of lime, or mineralogically, *apatite,* is at once the most abundant and that one which is found in the greatest variety of modifications. It belongs to the class of anhydrous mineral phosphates, a much smaller class than that of those which, containing water, are called hydrous. Neither apatite itself, nor any of its multitudinous varieties, is, however, a really simple anhydrous calcium phosphate; in fact, such a compound does not appear to have any existence in the mineral kingdom. The formula of such a salt would be,

$$Ca_3\,2\,PO_4.$$

Now apatite, like most native phosphates and arseniates, contains, even in its purest form, a considerable amount of fluorine or chlorine. If we represent these constituents by the symbol Y, the formula of apatite becomes

$$Ca_5\,3\,PO_4Y.$$

This symbol Y may stand for chlorine only, or for chlorine and fluorine, or for fluorine only. In some altered apatites, moreover, another variation in composition has been observed, namely, the partial replacement of the calcium chloride by an equivalent quantity of calcium carbonate. None of these variations, however, really affect the constitution of the mineral species itself, nor do they materially influence the percentage proportion of its most valuable constituent, the phosphorus. While the variations above noted occur within small and definite limits, especially in the crystalline and homogeneous forms of the mineral, it must be remarked that a wider range of variation is observed in many of the natural phosphatic materials which are employed in the manufacture of manures. Of this fact the so-called coprolites afford a striking example; but even our large commercial supplies of apatite itself do not wholly consist of the pure mineral. They often contain intruding and accompanying matters, which from a chemical, a mineralogical, and an agricultural point of view must be regarded as impurities. The chief of these are four in number, namely, calcium carbonate, ferric oxide, silica, and clay. It will be seen further on how the variety of composition caused by admixture with these substances has its origin in the very different conditions under which the several forms of apatite were produced. For we may call all these forms apatite, because when the intruding materials are deducted, the remaining constituents will be found to exist in proportions very near to those of the normal mineral itself.

It may be useful to give a brief outline of the chief physical and chemical characters of pure apatite, the peculiarities of its several varieties being noticed afterwards, when their localities and modes of occurrence are described.

Pure fluor-apatite may be regarded either as a calcium fluo-phosphate, or as a double salt containing 3 molecules of tricalcic phosphate and 1 molecule of calcium fluoride. In the latter case its formula becomes $3(Ca_3\ 2PO_4),\ Ca\ F_2$. The following numbers give the centesimal composition of this fluor-apatite :—

$$\left.\begin{array}{ll} P_2O_5 & 42{\cdot}26 \\ Ca\,O, & 50{\cdot}00 \end{array}\right\} = \left\{\begin{array}{c} \text{Tricalcic phosphate.} \\ 92{\cdot}26. \end{array}\right.$$
$$\begin{array}{ll} Ca\,F_2 & 7{\cdot}74 \\ \hline & 100{\cdot}00 \end{array}$$

Chlorapatite contains theoretically :—

$$\left.\begin{array}{ll} P_2O_5 & 40{\cdot}92 \\ Ca\,O & 48{\cdot}43 \end{array}\right\} = \left\{\begin{array}{c} \text{Tricalcic phosphate.} \\ 89{\cdot}85. \end{array}\right.$$
$$\begin{array}{ll} Ca\,Cl_2 & 10{\cdot}65 \end{array}$$

Specimens of both these forms occur having very nearly this theoretical purity of composition.

Pure apatite, especially when in fine powder, dissolves readily in the strong mineral acids,—nitric or hydrochloric. A slight crystalline residue often occurs, amounting to ·5 to 3 per cent. of the mineral; this usually is, or contains, cryptolite, a phosphate of the cerium metals, which is found accompanying apatite from a great many sources, and occurs particularly in the reddish apatite of Arendal, Norway.

When thrown on a hot plate, the powder of some varieties of apatite (phosphorite) phosphoresces, emitting a greenish light. Heated before the blowpipe in a small tube, apatite often gives off a trace of hydrofluoric acid, which roughens the glass. The fluorine is more easily detected by gently warming the powdered mineral with oil of vitriol in a platinum crucible covered with a watch-glass. This watch-glass should be coated with wax, except on one point at the centre of its convex surface; here a drop of water should be placed. If fluorine and silica be present, the water will thicken from deposition of silica, owing to the decomposition of the fluoride of silicon evolved; if fluorine be present without much silica the glass will be roughened.

The colour of apatite is very variable. Some of the crystallized forms are transparent, and destitute of colour, but usually they are of yellowish or greenish tints. The reddish or brownish aspect which some apatites present is not unfrequently due to the existence of minute interspersed particles of ferruginous and other minerals.

The lustre of crystallized apatite is vitreous; sometimes it is sub-resinous or even slightly pearly. The massive and concretionary varieties are often quite earthy and opaque in aspect, as is the case with the *osteolite* of Hanan, and much of the Estremadura *phosphorite.*

The hardness of apatite varies between 5 for the purest crystals and 4·5 for the compact and massive kinds. It is therefore scratched by a crystal of orthoclase felspar, and is itself capable of scratching fluor spar. Some apatites (*e.g., osteolite*) are remarkable for extreme toughness. Apatite shows, on breaking, a conchoidal fracture.

The density of apatite varies between 2·92 and 3·25. It is therefore heavier than either quartz or felspar.

Apatite crystallizes in the hexagonal system. But it often occurs globular and reniform (*staffelite*), fibrous or imperfectly columnar (*phosphorite*), earthy (*osteolite*), and in every condition intermediate between these varieties of structure and distinctly crystallized forms.

A. H. C.

THE GEOLOGICAL DISTRIBUTION OF TRICALCIC PHOSPHATE.

PHOSPHORIC PENTOXIDE[1] occurs in almost all plutonic and volcanic rocks, although presenting no indications of phosphatic minerals. Fownes found unequivocal indications of it in porcelain clay from Dartmoor, trachyte from the Drachenfels, and lava from Vesuvius. Bergmann found 1·8 per cent. in the lava of Niedermendig (Rhine). It has also been detected in basalt (Rammelsberg) granite, obsidian, greenstone, and other igneous rocks (Sullivan, in Bischoff, *Chem. Geol.*, vol. ii. p. 26). Apatite, when mineralogically recognisable in igneous rocks, may either have crystallized from a state of fusion, or have been gradually segregated by the action of water containing carbonic dioxide (*see* Bischoff, *loc. cit.*, p. 29). It is not always easy to know to which cause to attribute its presence. Recent lavas yield phosphoric pentoxide, but it is only

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[1] The chemical names employed in this paper are compared with those in common use in the following table:—

NEW NAMES.		OLD NAMES.
Phosphoric pentoxide,	$P_2 O_5$	Phosphoric acid.
Carbonic dioxide,	CO_2	Carbonic acid.
Tricalcic phosphate,	$Ca_3 2PO_4$	Bone-earth, etc.
Calcium fluoride,	$Ca F_2$	Fluoride of calcium.
Calcium carbonate,	$Ca CO_3$	Carbonate of lime.

old porous lavas that evidently contain apatite. A trachytic conglomerate near Bonn contains phosphorite (*Jahr. der Chem.*, viii. p. 966). Segregation may also take place more extensively when assisted by a disintegration of the rock. At Hanau, a layer of osteolite 4 to 5 inches thick is found underlying a soil of decomposed dolerite, from which it has probably been derived. Osteolite is found 1 inch thick between basalt columns in the Kratzer mine, Friedland, in Bohemia. According to Düne, it contained in 100 parts phosphoric pentoxide 34·64, silica 8·89, alumina 6·14 (*Jahr. der Chem.*, xi. p. 721). Apatite, on the other hand, has been found in basaltic dykes (*Jahr. der Chem.*, i. 1073; Dana, *Min.*, p. 533), and granite veins. In Cornwall it often occurs in metalliferous veins, especially those containing tin, as in St. Michael's Mount (*Dict. Chem.*, i. p. 348). Near Tavistock, francolite, a variety, occurs in lodes in considerable abundance.

In derived or sedimentary rocks, the aggregation of phosphatic minerals has been produced by different causes. Phosphates are essential to the existence of both plants and animals, and hence an amount of them is withdrawn from the inorganic world and more or less accumulated in organized structures proportional to the amount, and therefore to the requirements of the life of any one period. A comparison might in this respect be made with gold, the quantity of which in circulation continually increases, and the accessible deposits of which in civilized countries have been long almost completely exhausted.

In many cases, especially in rocks which have undergone metamorphic action, we find no organic structures in the phosphatic deposits. These, like graphite, are simply residuary evidence of formerly existing life, of which they are to some extent the measure.

In the following pages it has been attempted to collect together, as far as scattered and often very imperfect notices will allow, the different localities and strata in which phosphatic minerals have been found.

LAURENTIAN.—Apatite abounds in the marbles of Canada. It forms one-third of the coarse red marble of Burgess township (River Ottawa), and it also occurs in marble in Laurence County, New York (Bigsby, *Geol. Mag.*, i. 206). At Crown Point, Essex County, New York, it is quarried for agricultural purposes; and at Hurdstown, Sussex County, New Jersey, masses occasionally weighing 200 lbs. have been obtained. At this locality a shaft has been sunk and the apatite mined; some cleavage prisms have the planes 3 inches long (Dana, *Mineralogy*, p. 533). Apatite is also found in the marbles of Norway, but not in the same profusion as in Canada. In the Isle of Pargas, near Åbo, Gulf of Bothnia, it is sky-blue and green (moroxite), disseminated in whitish marble (Durocher, quoted by Bigsby, *Geol. Mag.*, i. 203). At Krageroe, in Norway, moroxite is found in minute crystals in hornblendic gneiss, and the massive radiated variety of apatite or phosphorite is also largely exported to England from the same place (Dana, *Min.*, 533). Apatite also occurs in almost every kind of metamorphic rock in various parts of Europe (*see* Bischoff, *Chem. Geol.*, ii. p. 23). Way found the New Jersey phosphorite to contain 52 per cent. of tricalcic phosphate, with a large proportion of calcium fluoride. A sample from the State of New York yielded 62·27 per cent. of tricalcic phosphate (*Journ. R. Agr. Soc.*, vol. xii. p. 220). Some specimens yielded higher percentages (p. 250). The apatite from Krageroe contains a high percentage. In four analyses made by Dr. Voelcker, it ranged from 89·37 to 91·60 per cent. It also contains no calcium carbonate and no fluorine, but an amount of calcium chloride which was found to vary from 2·16 to 6·41 per cent.

in pieces chipped from the same block (*Journ. R. Agr. Soc.*, vol. xxi. p. 354).

SILURIAN.—Black phosphatic nodules have been found in different silurian rocks in Canada (Bigsby, *l. c.*, p. 206). Those from the Chazy formation (lower silurian) at Allumette contain 36·38 per cent. tricalcic phosphate (Dana, *Min.*) At Logrosan, in Estremadura, Spain, phosphorite (so called) occurs in vertical layers 2 to 22 feet thick, alternating with clay slate (lower silurian ?) and a coarse quartz rock (Bigsby, *l. c.*, p. 202). Dr. Daubeny visited the locality, and published a description of it (Daubeny and Widdrington, *Journ. R. Agr. Soc.*, vol. v. pp. 406-418). He traced the deposit for about two miles, and found it varying from 7 to 16 feet in width. The statement that it was employed as a building stone (*see* vol. xxi. p. 356) he considered an utter fable. A phosphatic bed occurs at Cwmgwynnen, in North Wales, in the lower silurian. According to Mr. D. C. Davies, its position is in the midst of the middle and principal band of Bala limestone. The bed, as far as it has already been explored, has an area of four miles long by about eighty yards in width, with a thickness of about fifteen inches. Intersecting a hill almost vertically, it is worked by adit levels driven in from the hill-side (Davies, *Geol. Mag.*, iv. 252). It was first described by Dr. Voelcker at the meeting of the British Association at Birmingham, September 12, 1865.

Dr. Daubeny found in the Estremaduran phosphorite 81·15 per cent. of tricalcic phosphate, with 14 per cent. of calcium fluoride. Way found 85·5 per cent. of phosphate (*Journ. R. Agr. Soc.*, vol. xii. p. 220). Voelcker obtained, however, from average samples only from 72·69 to 78·79 per cent.[1] He describes it as having a fibrous structure, a light yellow colour, and a considerable degree of hardness. When powdered and placed on a heated iron plate, it, like many other varities of apatite, becomes beautifully phosphorescent (*Journ. R. Agr. Soc.*, vol. xxi. pp. 355, 356). Estremadura also contains other phosphatic deposits. At Montanches, eight leagues from Logrosan, "the phosphate is found in the cretaceous (?) strata, and in great abundance in the silicious bed; it presents a fibrous texture, and as the formations do not contain carbonate of lime it is more readily attacked by sulphuric acid" (*Comptes Rendus*, quoted in *Geol. Mag.*, ii. p. 446.)

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[1] D. Forbes is stated, probably by misquotation, to have found 44·12 per cent. phosphoric pentoxide in this phosphorite (*Jahr. der Chem.*, xviii. 907), a higher percentage than that of the purest apatite.

Phosphorite "from Jumillo, Spain," analysed by Voelcker, gave 37·02 per cent. phosphoric pentoxide (*Jahr. der Chem.*, xv. 763). De Luna found in it 1·75 per cent. of the cerium metals (*Jahr. der. Chem.*, xix. 946).

The phosphatic deposits of North Wales are described by Voelcker as consisting of a black shale and a black limestone. The former is the richer, and has yielded 28·4 per cent. phosphoric pentoxide, equivalent to 62·00 per cent. of tricalcic phosphate. The limestone, which also contains graphite, yielded 34·92 per cent. of phosphate.

DEVONIAN.—The Nassau phosphorite is found in surface pockets in rocks believed to be Devonian. Though probably originally derived from the rocks amongst which they occur, the deposits themselves are of tertiary age. Sullivan found traces of phosphoric pentoxide in the old red sandstone of Cork (Bischoff, vol. ii. p. 40).

CARBONIFEROUS.—Tricalcic phosphate in clay-slate, Fins, Allier, France (Meugy, *Ann. Mines*, 5^{e} sér. vol. xi. p. 150).—In the many and large beds of iron ores and of clay ironstone of Kentucky; 29·5 per cent. of phosphate in one of the latter at Crittenden (D. D. Owen, *Geol. Rep.*, p. 378, quoted by

Bigsby, *Geol. Mag.*, vol. i. p. 206). Nodular phosphorite is found in the coal measures at Dortmund and Sprockhövel. That from the first locality is a phosphate containing 20 to 25 per cent. of phosphoric pentoxide, with 15 to 20 per cent. ferric oxide, besides lime, alumina, and magnesia. It is used for agricultural purposes. The phosphorite from Sprockhövel contains 30 to 60 per cent. of tricalcic phosphate. It forms a bed 3 inches in thickness (*Official Catalogue of Mining Products*, from Zollverein; International Exhibition, 1862, p. 9). Lyon Playfair states that "coprolites" occur sparingly in mountain limestone (*Cyclopædia of Agriculture*, i. p. 544). The Burdiehouse limestone and the calcareous shale above it (lower carboniferous) contain numerous coprolites. Analyses of these have yielded amounts of tricalcic phosphate as low as 9·58 per cent., and as high as 85·08 (Dana, *Min.*, p. 534; *Cat. of Rocks*, Mus. of Pract. Geol., p. 88; *see* also Buckland, *Bridgewater Treatise*, i. 275). At Clifton, Bristol, the strata at the base of the lower carboniferous contain a bone bed with coprolites and fish teeth (*Catalogue*, p. 52). Coprolites, with teeth, fish bones, and scales, were found in "the coal formation of Silverdale, near Newcastle-under-Line," by Sir P. G. Egerton (Buckland, *l. c.*, i. p. 276).

PERMIAN.—A coprolite analysed by Rochleder, from Oberlangenau, contained 15·25 tricalcic phosphate (Dana, *Man. of Geol.*, p. 68).

TRIASSIC.—Professor Jaeger found many coprolites in the alum slate (Keuper) of Gaildorf, in Würtemburg (Buckland, *Bridg. Tr.*, vol. i. p. 190). Phosphoric acid distinctly ascertained in some triassic limestones (Fehling, *Quart. Journ. Geol. Soc.*, vii. 90). The calcareous conglomerate of the Kœssen beds (Keuper) at Westbury on Severn, contain bones, scales, teeth, and coprolites (*Cat. of Rocks*, Mus. Pract. Geol., p. 121).

The red marl (Keuper) which extends through the Midland counties, from Devonshire to the mouth of the Tees, probably contains tricalcic phosphate through its whole extent, Dr. Lyon Playfair having detected it in many samples. A century and a half ago it was the custom to dig this marl and lay it on land under preparation for wheat (Buckland, *Journ. R. Agr. Soc.*, vol. x. p. 525).

JURASSIC.—Dr. Buckland describes the (true) coprolites as so abundant on the shore at Lyme Regis, that they lie in some parts of the lias like potatoes scattered in the ground; and they are still more common in the lias of the estuary of the Severn, where they are similarly disposed in strata of many miles in extent, mixed abundantly with teeth and rolled fragments of bones[1] (*Bridgewater Treatise*, vol. i. pp. 188, 189. These curious fæcal remains are figured in Pl. xv. figs. 3, 4, 10, 11, 12, 14, 17, 18; *see* also *Memoir in Trans. Geol. Soc.*, N. S., vol. iii. part i. p. 224). Phosphorite is found at Amberg, Bavaria, according to Dana (*Mineralogy*, p. 533), in Jurassic limestone, nodular, and stalactitic. It was exhibited among the mineral products of the Zollverein at the 1862 Exhibition, by Professor Martins. It is stated (*Catalogue*, p. 99) to have been discovered as detritus in 1816, but found by the exhibitor in larger quantities in 1855. The two following references are from Dr. Bigsby's paper:—Phosphoric acid very distinct in some Jurassic limestones (Fehling, *loc. cit.*); Tricalcic phosphate in the marl beds of the lias Calvados, etc.; in Jurassic rocks, St. Thibault, Côte d'Or (Meugy, *Ann. Mines*, 5e sér. vol. xi. p. 150).

A coprolite from Lyme Regis, Herapath (*Journ. R. Agr.*

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[1] These bone beds of the lower lias are seen in the well-known Aust Passage cliffs. The remains accessible would not repay collecting for commercial purposes (vol. x. p. 520).

Soc., vol. xii. p. 99) found to contain 60·76 per cent. of tricalcic phosphate, with 4·05 per cent. ferric phosphate, and a trace of the phosphates of both magnesium and aluminium. A pure white piece of the phosphorite of the Jurakalk of Amberg gave to W. Mayer 39·57 per cent. of phosphoric pentoxide, 2·78 per cent. carbonic dioxide, and a trace of iodine (*Jahr. der Chem.*, x. 686); and, according to Reinsch, a trace of bromine in addition (Dana, *Min.*, 532).

CRETACEOUS—*Lower Greensand.*—This formation contains a deposit of phosphatic nodules at Sandy, Bedfordshire. The following account is borrowed from a paper by the Rev. P. Brodie (*Geological Mag.*, iii. pp. 153, 154):—" The phosphatic nodules are mixed with pebbles and other extraneous matter. The whole sometimes form a kind of conglomerate. They lie generally at a variable depth from the surface, in some cases cropping out, in others with a capping of three to four feet of soft sand, but none have been met with below six feet from the top. The interior of the nodules is of a black or brown colour, and often, though not always, envelopes an organic body, generally an ammonite (A. Lamberti) of the Oxford clay. The nodules are of all shapes, rounded and elongated, and frequently pitted on the surface, but comparatively of small size. Associated with them are lumps of hardened clay, which are more or less phosphatic. The fossils, which are usually much water-worn, are all more or less enveloped in, or permeated by, the phosphatic matter. They are all evidently extraneous, and were derived probably from the destruction of the Oxford and Kimmeridge clay, and intervening coral rag, from which the phosphatic matter must have been obtained while the lower greensand was in process of formation. Where, as in this case, there is a large preponderance of animal remains, it seems most probable that the phosphates were purely of animal origin, and were derived especially from saurians and fish."

According to Dr. Voelcker, these nodules vary much in composition, and are not so valuable as those from Cambridgeshire. The top beds are the richest. The phosphatic matter contains a good deal of iron, derived, no doubt, from the formation in which they are embedded. Some of the best average samples yield, according to Dr. Voelcker, 22·39 per cent. of phosphoric pentoxide, equivalent to 48·51 per cent. tricalcic phosphate (*see* also *Ann. and Mag. of Nat. History*, third series, vol. xviii. Nov. 1866).

The coprolite workings in the Fens at Upware, twelve miles from Cambridge, also belong to the lower greensand. The bed differs from the "sandy conglomerate bed" in being less ferruginous, and containing more lime. The nodules are mixed with pebbles, which are picked out by women and children; about a third part is waste. In one section three layers were noticed. They often become blended into one, but the top layer differs in the nodules, being of a much lighter colour, and these are less valuable. Among the nodules there are found phosphatic shells as in the bed near Potton (Morris, *Geol. Mag.*, vol. iv. p. 459). They consist principally of casts derived from older deposits, such as the Oxford clay (Walker, *Geol. Mag.*, vol. iv. pp. 309, 310, and vol. v. p. 26; Keeping, vol. v. p. 273).

At Farnham a bed just below the gault, which seems to be very persistent, yields fossils containing phosphoric pentoxide equivalent to 42·28 per cent. bone-earth phosphate. The matrix is almost wholly destitute of it (Paine and Way, *Journ. R. Agr. Soc.*, ix. pp. 76-79).

Gault.—Near Ely the Gault contains scattered spherical phosphatic nodules two or three inches in diameter, but unlike those of the greensand, in not being rolled (Seeley, *Geol. Mag.*, vol. ii. p. 530). At Upware it contains a phosphatic bed about five inches in thickness, and containing fossils (Keeping, *Geol. Mag.*, vol. v. p. 273). Phosphatic nodules have also been found in the gault of Wiltshire (*Catalogue of Rocks*, p. 156); at Folkestone (*Geol. Mag.*, vol. v. 163); at Mildenhall in Suffolk (Fitton, *Trans. Geol. Soc.*, vol. iv. pt. ii. p. 312). A large gault fossil from Farnham contained 24·28 per cent. of phosphoric acid, according to Paine and Way (*Journ. R. Agr. Soc.*, vol. ix. p. 76), who remark that in all cases the analyses of the fossils showed them to be extremely rich in phosphoric pentoxide; but nowhere do they seem to exist in quantities large enough to pay the expenses of digging for them. The Speeton clay of Yorkshire, classed by Phillips with the gault, also contains phosphatic nodules (Morris, *Geological Chart*).

Upper Greensand.—The phosphatic nodules found in this formation in Cambridgeshire are dug out by cutting trenches down to the sands, and then, after scooping out the deposit, laterally disengaging the upper stratum from above by means of crowbars, so as to expose a new section. Contractors pay £100 an acre for working over the land in this way. The nodules are embedded in a soft matrix of marl and glauconite (chloritic marl), a stratum varying from six inches to a foot thick, which is all that represents the upper greensand; from this they are separated by washing. The nodules vary much in size, up to a diameter of three or four inches. Most often they are irregular concretions, without any definite shape. When broken they are dark brown, having a dull fracture. Nearly all the fossils of the bed have been mineralized and infiltrated by the phosphate of lime (Seeley, *Geol. Mag.*, vol. iii. p. 307). At Farnham, the chloritic marl or uppermost division of the upper greensand contains phosphatic nodules (*Journ. R. Agr. Soc.*, vol. ix. p. 62). The same stratum occurs in the Isle of Wight, and as far west as Chard in Somersetshire (pp. 75, 76). In the same position, immediately below the chalk, they were found in an excursion from the College to Calne in Wiltshire (*Practice with Science*, vol. i. p. 355).

According to Dr. Voelcker, the Cambridgeshire "coprolites" contain from 54·89 to 58·52 per cent. of tricalcic phosphate. Owing to their containing much calcium fluoride, which is precipitated in determining the phosphates, the amount is usually stated 3 to 4 per cent. too high (*Journ. R. Agr. Soc.*, vol. xxi. p. 358). At Farnham, 61 per cent. of a mass weighing 30 lbs. consisted of fossils. These yielded on analysis 59·60 per cent. of bone-earth phosphate, the matrix itself containing 13·63 per cent. (Payne and Way, *Journ. R. Agr. Soc.*, vol. ix. pp. 71, 72). The existence of phosphatic nodules in the upper greensand at Cambridge was first announced by Professor Henslow, at the meeting of the British Association at Cambridge, in 1845. The French "coprolites" are derived from the lower chalk, greensand, and other rocks of nearly the same age; Wissant, Havre, Rethel, near the Ardennes (Meugy, *Comptes Rendus*, vol. xliii. p. 755). "Coprolites" from Rethel gave 21·29 phosphoric pentoxide (*Jahr. der Chem.*, ix. 907). A bed of tricalcic phosphate at the base of the chalk, although only a few inches thick, extends, with a varying breadth, 550 miles in Russia (Count Reyserling, *Bullet. Soc. Géol. Fr.*, N. S. vol. iv. p. 11).

Chalk Marl.—This formation, the lowest division of the chalk proper, sometimes contains hard calcareo-phosphatic nodules, as at Henley and Marlborough. Nodules from the last place have been found to contain 10 per cent. of phosphates (*Catalogue of Rocks*, p. 160). Chalk marl is sometimes used as a manure. In one locality where it was so employed it contained 3·75 per cent. tricalcic phosphate (*Journ. R. Agr. Soc.*, vol. ix. p. 61). Buckland figures two true coprolites from the chalk marl at Lewes (Pl. xv. figs. 5 and 6; fig. 13 is a specimen from the greensand of Virginia). The small green granules in the chalk of Cape la Neve consist of apatite, according to Berthier (Bischoff, vol. ii. p. 23). A layer occurring at the base of the Sénonien (= white chalk and chalk marl in part), in the Département du Nord, gave De la Noue 15 per cent. of phosphoric pentoxide (*Jahr. der Chem.*, vii. 907). The same observer also obtained 15 per cent. from "coprolites" occurring with glauconite at the base of the white chalk in Belgium (*Jahr. der Chem.*, vii. 908).

TERTIARY—*Miocene.*—Phosphorite at Pilgrimsreuth, on the declivity of the Füstelgebirge, in layers two or three inches thick, in a sandy clay, beneath a bituminous shale, constituting the underlying layer of brown coal. This is much more impure than that which occurs in nests in the basalt of the same locality, and contains fluorine (Bischoff, ii. p. 23). A phosphatic nodule from the brown coal near Roth contained 45·57 tricalcic phosphate, 2·04 magnesium phosphate, and 27·71 iron phosphate per cent. It was pitch black in colour outside, and a honey yellow within (Dana, *Min.*, p. 534, and *Jahr. der Chem.*, ix. p. 907).

Pliocene.—Mr. Lankester describes the so-called coprolite bed of Suffolk, for which he proposes the less exceptionable name of bone bed, as a great beach or littoral accumulation (like all other bone-beds), formed immediately before the coralline crag, from the detritus of the London clay, the Diestien or black crag, and the fragments of subaërial and fresh-water accumulations. The cetacean and shark remains were derived from a previous deposit of the age of the Système

Diestien in Belgium. They are in a different mineral condition from the bones of terrestrial animals, very rarely found with them, the animals to which they belonged being usually only represented by the enamel crowns of their teeth. Mr. Lankester remarks, that the bones of land animals must have come on to the bone-bed beach either in a very fresh condition, or in a very different state of preservation from those of the Diestien cetaceans. The phosphatic nodules are masses of London clay, often with characteristic fossils, such as may now be seen rolled about on Suffolk beaches. They have nothing in common with coprolites (*Geol. Mag.*, vol. v. pp. 256, 257). Dr. Voelcker describes the bed as forming a layer from three to eighteen inches in thickness. The nodules are smooth, and of a brown ferruginous colour. They are very hard, and yield on grinding a yellowish red powder. One analysis gave an amount of phosphoric pentoxide equal to 52·52 per cent. tricalcic phosphate. This represents a good average sample (*Journ. R. Agr. Soc.*, vol. xxi. p. 360 ; *see* also *Analysis* by Herapath, vol. xii. pp. 97, 98).

The Nassau, also called German or Rhenish phosphorite, is found in concretionary masses embedded in a matrix of clay, contained in pockets in a Dolomitic limestone of Devonian age. Above the deposits of phosphorite is a layer of brown clay, belonging to the glacial period. The concretions are irregular in shape, and vary in dimensions, from the size of an apple to masses weighing two or three tons. The original concretions seem to have been subject to a good deal of attrition. They contain from 50-70 per cent. tricalcic phosphate. The proportion, however, rises in places to 92 per cent., the deposit then assuming the crystalline form of apatite (Davies, *Geol. Mag.*, vol. v. pp. 262-266). Dr. Charles Graham considers the most probable explanation of these deposits to be, that they are the result of the action of carbonated water on the schists of the middle Devonian. The water, finding its way to lower levels, left, on evaporation, the phosphatic matter in the pockets of the limestone. The phosphatic solution seems to have bound together whatever existed at the spot where evaporation took place. In some cases he found iodine contained in the phosphorite in appreciable quantity (*N. British Agriculturist*, Jan. 20, 1869).

RECENT.—Guano, according to Humboldt, is the European pronunciation of the Peruvian word "huanu," meaning dung or manure. It occurs at various points along the coast of Peru, between the 13th and 21st degrees of south latitude, both on the mainland and on the islands and rocks along the shore. The deposits are irregular, sometimes attaining a depth of fifty or sixty feet, and are composed wholly of the dung of sea-fowl, with occasionally bones and feathers (Johnston, *Journ. R. Agr. Soc.*, vol. ii. pp. 301, 302). It is the dryness of the climate which has permitted its accumulation. Cold water dissolves three-fifths of the guano in the state in which it reaches us (p. 315). Darwin remarks, it has become almost a proverb, that rain never falls in the lower part of Peru. On the mole at Callao, he saw shiploads of wheat piled up and left for weeks without shelter (p. 314). Humboldt first brought specimens of guano to Europe in 1804. The natives, however, employed it as a manure from the earliest ages. The best Peruvian guano comes from the Chincha islands, which lie in S. lat. 14°, about ten miles from the mainland. They consist of granite, covered with guano in some places to a height of 200 feet. In several places the surface of the guano is strewed with masses of granite. None are found, however, embedded in the guano, only skeletons of birds (Ure in *Journ. R. Agr. Soc.*, vol. v. p. 289). Guano deposits in other places have not been exposed to climatic conditions so favourable for their preservation. The organic matter has been gradually dissipated with the nitrogenous constituents by oxidation, and the soluble constituents have been washed out by rain. In this way the phosphatic deposits known as rock guanos have been formed. "The waters which have filtrated through the guano at Sombrero (a small island sixty miles from St. Thomas) have altered the coral rock adjoining, turning it more or less completely into phosphate of lime of a yellowish or brownish colour" (Dana, *Min.*, p. 535). This is the Sombrerite of Phipson, who, most improbably, considers it a rock which has "found its way to the surface at a high temperature, in contact with water or steam, and under great pressure" (*Journ. Chem. Soc.*, xv. p. 278). Dr. Voelcker possesses a specimen containing pieces of bone, which are white and perfectly free from organic matter. The colour is rather variable (*Journ. R. Agr. Soc.*, vol. xxi. p. 363).

Monk's Island guano occurs in large lumps, in which pieces of quartz rock are often embedded. It consists chiefly of a mixture of calcium pyrophosphate and tricalcic phosphate (p. 362). In the island of Ascension, stalactite masses of impure tricalcic phosphate occur in basalt, near guano, from which it is probably derived (Bischoff, ii. p. 23).

An average sample of true guano would contain about 12 per cent. phosphoric pentoxide. Sombrerite was found by Voelcker to contain phosphoric pentoxide equivalent to from 69·42 to 76·90 per cent. tricalcic phosphate (*Journ. R. Agr. Soc.*, vol. xxi. p. 363). Monk's Island guano yielded, in a single analysis, 41·34 per cent. phosphoric pentoxide (p. 362).

The accumulations of phosphatic matter in stratified rocks have been derived from different organic sources. The term Coprolite, originally applied by Buckland to fossil excrements, was soon erroneously extended to all other phosphatic products of fossiliferous rocks. These Buckland subsequently proposed to call pseudo-coprolites. He also applied the term Phosphorite to them, which is open to objection, as being the name of a definite mineral, and not therefore properly applicable to the mixture of materials forming a phosphatic deposit (see *Journ. R. Agr. Soc.*, vol. x. p. 521).

Marine plants have probably been the source of the phosphatic ingredients of many rocks. This would be especially probable where the rocks are in other respects poor in organic remains. Sea weeds, while contributing their constituents to the sediment in which they have been embedded, would usually leave no impress of their form. Lyell remarks, that the great banks of drift sea-weed in the equatorial oceans must produce when they subside considerable beds of vegetable matter. In Holland, also, submarine peat is produced from fuci, and on our own coast from sea wrack (*Zostera marina*). Sea weeds thrown up after storms would become embedded in shore deposits (*Principles of Geology*, vol. ii. p. 571). Sea wrack, as well as many sea weeds, contain a considerable amount of phosphates. The ash of *Zostera marina* yields 9·8 per cent. tricalcic phosphate (Baudrimont in *Dict. of Chem.*), the ash of *Fucus serratus*, from the mouth of the Clyde, 9·67 per cent., and *Iridæa edulis*, another sea weed, 23·23 per cent. (for other analyses see *Dict. of Chem.*, vol. v. p. 216). Mr. Seeley is inclined to attribute the phosphatic matter of the cretaceous rocks in part to vegetable remains (*Geol. Mag.*, vol. ii. p. 531). Animals, however, accumulate in their tissues far greater amounts of phosphoric pentoxide than plants, and it can hardly be doubted that the greater part of the phosphatic accumulations of sedimentary rocks are derived from their remains. The bodies of mollusca, whose shells compose almost the whole bulk of some rocks, would supply much phosphatic matter, though, as it might pass into solution again in their gradual decomposition, it would not necessarily follow that it would be found in the strata that contain the shells. Amongst the brachiopoda the shells themselves are sometimes phosphatic; thus, a fossil lingula from Hawkesbury, Canada, contained 44·7 per cent. tricalcic phosphate (*Jahr. der Chem.*, vol. vii. p. 711). That this could not be a case of gradual replacement of calcium carbonate by phosphate is shown by the composition of the shell of the recent *Lingula ovalis* (Reeve) from the Sandwich Islands, which was found by Henry Hart to contain 85·79 per cent, of tricalcic phosphate (*Jahr. der Chem.*, vol. vii. 908). As the brachiopoda were the most prominent molluscs of the Palæozoic age, it may be conjectured that they contributed to form some of those phosphatic deposits in which no organic remains can now be traced.

In many instances the deposits owe their phosphates to the bony remains of the higher animals. Beds of fish bones are known in existing seas, where they are gradually accumulated by currents. Such a bone bed exists eastward of the Faroe Isles, and is three miles and a half in length. Fish bones occur in this tract in such profusion, that the lead cannot be drawn up without some vertebræ being attached (Lyell, *Principles of Geol.*, vol. ii. p. 576). In other cases the bones have been accumulated in shore deposits. The larger cetacea can only float in a considerable depth of water, and consequently remain stranded on low shores on which they have been carried during storms (*see* Lyell, *op. cit.*, p. 572). This which only occurs occasionally in our own country, might in some situations happen frequently enough to produce considerable accumulations of bones. A cargo of whale bones was on one occasion brought to Liverpool, which had been obtained from such a shore accumulation on the West Coast of Africa. The formation of beds would be accounted for by a gradual subsidence going on at the same time. The land edge of the deposit would gradually advance, while the older accumulations would be covered up by the sea (*see* Darwin, *Origin of Species*, p. 350).

But although phosphatic deposits such as those of the upper greensand in Cambridgeshire and the crag in Suffolk, contain bones rolled by littoral action, the phosphatic matter in the deposit is not now restricted to the bones alone. The concretionary nodules, and even shells, found with them, are all more or less phosphatized. The phosphatic matter, however, it can hardly be doubted, has been derived principally from the bones. Tricalcic phosphate is gradually dissolved by water containing carbonic dioxide. The presence of sodium chloride also facilitates its solution (Bischoff, vol. ii. p. 28). Both conditions are supplied by sea-water, and would be aided by the mechanical disintegration of shore action. Even without this, the mere solvent action of sea-water is known to be sufficient to destroy bones when not protected by covering sediment. It is not easy, or perhaps with the present knowledge of the subject even possible, to trace completely the processes by which the phosphates have been again withdrawn from solution by the nodular masses. Warington found that pure hydrated alumina and ferric oxide, when allowed to remain in contact with a carbonated solution of tricalcic phosphate, absorbed the phosphoric acid almost completely (*Practice with Science*, i. 324). An experiment made in the laboratory of the Royal Agricultural College, proved that kaolin also possessed the power of withdrawing some tricalcic phosphate from a solution with which it was shaken up. These facts at any rate show that there is nothing to invalidate the possibility of argillaceous and ferruginous nodules gradually appropriating from the sea-water which washes them the phosphates which it had dissolved. It must, however, be remembered, that neither the solution of the phosphatic matter of the bones nor their transference to the nodules would cease on their removal from marine influence. Probably the greater part of this work would be done subsequently in the deposit itself by meteoric water containing carbonic dioxide. Von Bibra did not find a trace of phosphoric pentoxide in fossil bones from the Keuper limestone; with the exception of 4 per cent. of lime, none of the original constituents remained (Bischoff, ii. p. 39). Warington ascertained that the solubility of tricalcic phosphate in carbonated water is almost completely destroyed by the presence of calcium carbonate. This throws some light on the replacement of calcium carbonate by tricalcic phosphate. Thus, in a fossil sponge from the chloritic marl of Farnham analysed by Way (*Journ. R. Agr. Soc.*, ix. p. 68), while the exterior contained 32·27 tricalcic phosphate, and 61·71 calcium carbonate per cent., in the interior the first constituent had fallen to 10·26, while the other amounted to 69·17 per cent. This difference in composition is explicable if we suppose that, as the calcium carbonate passes into solution the phosphate passes out.

W. T. T. D.

THE FEEDING OF STOCK.

BY

W. J. EDMONDS,

SOUTHROP, EASTLEACH.

THE FEEDING OF STOCK.

I DO not propose to enter into any statistical comparative values of the different kinds of artificials, such as corn, cake, etc., or of their analyses, because I consider that the very valuable opinions of our scientific friends upon these subjects can be best considered by quietly studying their works, and consulting them as we require their assistance; and I would wish to bear my testimony to the amount of instruction and of advantage that I have gained from the lectures and works of these gentlemen, and from none more than from those of our respected friend Dr. Voelcker. In speaking of the feeding of stock, we have, I think, to consider principally the sort of stock most profitable to buy for feeding; the food on which to feed them; and the management during feeding. First, then, what should guide our choice in the purchase of stock bought for feeding? I would first say, never buy culls—it is the worst thing a grazier can do, for although they may appear cheap, they really are not so, for they are either ill-proofed, and consequently will not do justice to the food they eat, or (especially in the case of sheep) they have received a check, and as they begin to thrive, so surely do they begin to die. As an instance that I am not alone in this idea, I may mention the case of an eminent grazier, I believe it was the late Mr. Trinder of Wantage, who always after purchasing his different lots of grazers, the best he could find, looked over them, and picked out all those he considered as not likely to fatten well and quickly, and sold them to a dealer at the best price he could get. It may be asked who is to fatten the ill-bred and cull animals? I will answer that the more they are at a discount, the more careful will breeders and dairymen be to improve their stock; and so avoid keeping that kind which graziers dislike to buy. One of the best points to guide a grazier in the purchase of his stock, is that of a well-formed head, with a full yet mild eye. We generally find in all animals if we can get that, we are tolerably sure to have with it a well-made frame and an aptitude to fatten; and why? Because it is a proof that such animals are well bred, and thus have good qualities. Of course there may be exceptions—for instance, we may meet with thin-fleshed ones, or what are called shelly ones, they should be at once rejected; indeed, we cannot do better than study Mr. Rham's description of a well-made frame. He says, speaking of cattle, "There are certain forms and appearances which are anatomically connected with a perfect conformation of the body, and especially of the organs of respiration and digestion. Of this kind, are a wide chest, well-formed barrel, strong and straight spine, hip-bones well separated, and length of quarter—all which can be proved to be essential to the perfect functions of the body. Small and short bones in the legs give firmness without unnecessary weight. A thick skin well covered with hair insures proper warmth, and its soft loose feel indicates a good coat of cellular substance underneath, which will readily be filled with deposited fat. All these are indispensable points in an ox which is to be profitably fatted, and whatever be the breed, they will always indicate superiority." With regard to sheep, we have Mr. Ellman's opinion of the necessary shape and quality of the Southdown, and Mr. Culley's opinion of the points necessary to be observed in the purchase of Longwools. Mr. Ellman, after describing the shape of the head, etc. (beautiful and living specimens of which are to be seen in the sheep which so often browse in Lord Bathurst's park), goes on to say, "The neck should be of medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high, and straight in its whole course above and below; the chest wide, deep, and projecting between the fore legs, indicating a good constitution and a disposition to thrive; the shoulders on a level with the back, and not too wide above, but bowing outward from the top to the breast, leaving room for the springing rib behind. The ribs coming out horizontally from the spine, extending far backwards, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat, the rump long and broad, the hips wide; the space between them and the last rib on either side as narrow as possible; and the ribs presenting a circular form like a barrel." Further on he says, "The meeting of the thighs should be particularly full and the bones fine, but having no appearance of weakness." Mr. Culley's description of the proper form and character of a long-wool sheep is very similar. He says "the head should be long, small, tapering towards the muzzle, the eyes prominent, but with a quiet expression. The ears thin, rather long, and directed backwards; the neck full and broad at its base, gradually tapering towards the end, the neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the poll; the breast broad and full, and there should be no uneven formation where the shoulders join either the neck or the back, particularly no rising of the withers or hollow behind the situation of those bones." Then he speaks of the chest, barrel, and quarters, in the same strain as Mr. Ellman, especially mentioning that the thighs should be wide and full. In the same way with store pigs, regard must be had to their general good quality, and hence to their breed, if we wish to make pig-feeding pay; and although we may not be able to find grazing stock generally to bear out in all points the descriptions I have quoted as given by Mr. Rham and others, yet I would suggest that in buying to graze, buy good ones of the sort, whatever the breed and whatever the description. One thing we should never lose sight of, and that is, that the public, and as a consequence the butchers, want plenty of lean meat with the fat, therefore we should always select those animals which carry, or are likely to carry, plenty of natural flesh, as well as have an aptitude to fatten. It does not, in my opinion, come within the province of this lecture even to suggest the particular breed which is most to be recommended, as we all hold our different opinions, and indeed each breed has, I suppose, its particular merit. Possibly particular soils and difference of climate may cause this or that breed, even of cattle and pigs, to suit this or that particular county, and most certainly does this happen with regard to sheep. For instance, long-wools, the pride of the Cotswold country, will degenerate, and in point of fact are profitless in parts of Wiltshire, in Sussex, and, it may be said, in the Southdown counties. I can mention an instance. My late father, as a young man farming in this neighbourhood, left it for Wiltshire. He had a partiality for the Cotswolds, and took them with him; but he was obliged to change in a very little time, as they lost their size, and the fleeces were almost all cotted. We now come to

THE FEEDING OF ANIMALS.

Let us begin with cattle. It is hardly necessary to say anything of summer or grass feeding, excepting that I think that where our grazers are in forward condition at lattermath, a little money is well laid out in providing oilcake to be given them from some part of the last fortnight in August, according to abundance of keep and the state of the weather, until they come to stall, which they ought to do during the middle fortnight of September. I am speaking now of Christmas cattle. Of course others which are to be kept until the spring, may with advantage be out another fortnight, or possibly three weeks—but in no case longer than they are seen to be improving in condition, because from the moment they cease to thrive out of doors, until they come to stall, the grass they are eating is all wasted—grass which would be very useful and valuable for still later cattle, or for sheep before coming to turnips. Now I apprehend that the problem we want to solve with regard to stall-feeding is, what food, or what proportions of different kinds of food, shall we give our fatting cattle in order to make the greatest weight of meat at the least cost. I have heard of grazers who have given to large heavy oxen as much as 14 lb. of oilcake a day, with hay *ad libitum,* but most of us would be inclined to say that such feeding was extravagant. We know that it is useless to give an animal more stimulating or nutritious food than it can assimilate, for if we do, the excess is voided by the animal, and although we may have very rich manure we have a very expensive one. I must confess I am an advocate for steamed food, as I have tried it on rather a large scale this year, and found it to answer admirably.* For fatting cattle I should recommend two parts hay and one part straw, or in forward animals three parts hay and one part straw cut into chaff. Those of average size will eat about five bushels per day, with 4 to 5 lbs. oilcake, and a half-peck of mixed meal, composed of barley and peas or beans, and if cheap, a proportion of wheat also, the quantity to be increased to one peck per day in a month or six weeks after they have come to stall, the oilcake and meal to be boiled in water for half an hour, or three-quarters, and thrown in the form of rich soup over the chaff, and well mixed, a little salt being added. The perfume arising from such chaff is that of newly made hay, and the animals eat it with avidity. The mixture with the chaff should never be made more than twelve to fourteen hours before it is used; seven or eight hours is still better, or it becomes a little sour, and beasts do not like it so well. A double quantity can be boiled on Saturday to be kept in tubs, and mixed as required. There is no waste, every particle of food is eaten; and I maintain that in this way the food is rendered more digestible, the animals have less difficulty in assimilating it, and that therefore the greatest amount of nourishment which can be derived from it is obtained. My Christmas cattle were fed in this way, with the addition of a peck of roots, and the six best were sent to London, and made £39 each into pocket. They handled remarkably firm, and the price shows that they were not only heavy, but also well fed beasts, for the market was, as all may recollect, by no means a brisk one. In support of my own view of cooked food, I may mention that the late much respected Mr. W. Bowly cautiously commenced the system, gradually adopted it for all his cattle, and ultimately spoke highly of it. The following is a receipt I had from his man. A furnace of 70 gallons is sufficient for fifteen cows. Fill the furnace with water and boil, then put in 10 lbs. flour per cow, stirring and boiling gently for an hour; put some chaff, three bushels per cow, into a long trough (a cow will eat in the day six bushels), then mix with it half the boiled meal, and give it the cows in half-an-hour; the other remaining for use in the afternoon. Again, Mr. Duckham, in a lecture at the Central Farmers' Club says, "In consequence of a short supply of hay and a failing crop of roots, with the prospect of a high price for beef, and a low price for corn, I was induced to substitute straw chaff for hay chaff, and in the absence of roots, to make linseed tea, which was applied boiling hot upon the chaff, with a little salt, and the meal added thereto. This, with a little hay in the rack at night, constituted their food. I prefer applying the linseed tea boiling hot, as it softens the straw, and renders it more digestible. I never saw my steers and cows feed faster than they did under that system." By adopting this plan we are rendered more independent of roots for our feeding cattle; still, wherever roots can be had, I have no doubt that a peck, or even half a bushel a day, would be an economical and also a valuable addition to other food, more especially where dry food would otherwise be given. They should by all means be pulped and mixed with the chaff one day before the other is added, and I have no hesitation in saying that the introduction of the pulper, by enabling us to do this, has been a most valuable assistance, as I know by experience how much faster cattle thrive with such food than with the same quality of dry chaff and sliced roots. To return for one moment to nutritive foods, I would just say that whether they are given in a dry state, or steamed, it seems to me to be desirable to give smaller quantities of different kinds, rather than a larger quantity of one kind; and with regard to hay, I hold that although on grass farms it may be perfectly right to give it to feeding cattle unmixed with straw, yet to do so on our arable farms, where every ton of hay is of great consequence to us, is to be condemned as extravagant and wasteful. By this I must not be understood to mean that hay is not an essential in feeding; all I contend for is that in economizing our hay by the intermixture of straw we are enabled, with the help of a moderate quantity of our nutritive foods, rich as they are in flesh-forming material, and in heat-giving and fattening matters, to feed profitably one quarter or one third more than we otherwise could. On the other hand, I much doubt whether feeding—that is, fatting cattle, could be profitably carried on without some hay, because straw, being so very deficient in flesh-forming material, would require a large quantity of artificial food for a long time to make up that deficiency. We now come to

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* One hundred-weight of coal would be quite sufficient to steam food for 40 beasts.

CONDIMENTS.

I remember once having a young ox which did not thrive; in fact it looked altogether out of health. Medicine seemed of little avail, so we gave it cake, etc., to try as a last resource whether high living would move it, but to no purpose. However, just at the time Mr. Lane asked us to try his cattle food, and we had a bag. It was then at a high price—about 30s. per cwt., I think. After giving some to the ox, according to the directions, for about a fortnight, the old man who looked after it, and who was a disbeliever in any good being effected, told us that certainly the ox was better, the skin was looser, and it appeared likely to thrive. And so it did, and it went on well from that time, entirely, we all believed, from the effect of the condiment, and was sold in due course for £20. The lung was found to be unsound. Now, had we given double the price for the condiment in that instance it would have answered, and I am inclined to think that such stimulants which can now be made for from £12 to £15 per ton, are very usefully given the last six weeks or two months of feeding, as they stimulate the appetite and assist digestion. Another food there is that I have not mentioned, which would, I believe, be largely and beneficially used as a condiment, were it not that at the present time the law practically disallows its use by raising its price, through vexatious restrictions, beyond its value as a cattle food. I mean our own barley, which, having been sprouted and dried again, takes the name of malt. A few words with regard to

THE BEST KIND OF STALLS

for feeding cattle. I incline very much to the opinion that covered ones are the most desirable, provided they are so arranged as to be comfortable, having plenty of ventilation, and not too high. The best I have seen for the comfort of cattle are in Braden, at a farm belonging to my friend Mr. Ruck. It may be, and I think it likely, that cattle require less food under well-arranged covered sheds than in open ones, but by far the greatest benefit to be derived from them, in my opinion, is the better quality of the manure so obtained. I have thought more of this subject since Mr. Gilbert's lecture here in December, when he explained to us the value of liquid manure; and if the difference in the value of the liquid and solid excreta is the same in animals as in those of the human frame, many of us, I fear, from many causes, are losing a great portion of our most valuable manure. Mr. Moscrop, in his essay on covered yards, which may be found in the second series of the *Royal Agricultural Journal*, vol. i. part 1, says, that in an experimental trial, animals with something under one-eighth less food gained as much weight as others fed with the same description of food, but kept in the common form of court or shed. He then goes on to give some startling facts with reference to the superiority of the manure. Mr. Thompson, too, speaks strongly on that point. However, we are, for the most part, so situated, that we must endeavour to do the best with what we have; and I would suggest that at all events we should spout our buildings, keep straw under our cattle, and if the dung be wheeled to a heap day by day, salt the heap from time to time, and further so arrange matters that wherever our cattle are, draughts should be excluded. We now come to the

MANAGEMENT OF CATTLE DURING FEEDING.

I remember in a lecture given by Mr. Beasley, of Northampton, at Faringdon, some five or six years ago, he said, addressing himself to the young gentlemen who were present, "If you were to ask me to give you a motto for your guide in business, I would give you these three words—Attention to details. You might construct a very clever and very powerful machine, perfect in all its design and mechanism, but by omitting one little cog-wheel probably it would not go, and you would be as unsuccessful as if you had forgotten the chief moving power." So, in this case, it is quite certain that we may buy the most perfect grazers, give the best food and the proper quantity, and yet the condition of our cattle will disappoint us, if the feeder does not understand his business, or is a careless one. As soon as a feeder has attended to a certain number of cattle for three or four days, he can tell to a nicety their probable appetite, and will give a little less or more to the one or the other as the case may require. Small quantities should be given at a time. Of the steamed food, a peck is quite sufficient, and during the intervals of feeding the cowman should always clean out the pens, or the inside part of the stalls, if he have but a few to attend to, or if many, a boy should be employed for the purpose, so that, as soon as the animals have finished eating, which will take them about an hour and a half, they may go at once to their clean stalls and lie down. That is the plan we adopt. Our feeding times are morning and evening, but they have a small quantity as a sort of lunch in the middle of the day. One great point in feeding (and the remark applies to all kinds of animals) is to give as much food as is required and no more. If, as a rule, we find empty feeding places at nine or ten o'clock, and in the evening, and our cattle lying down, either ruminating or asleep, and we hear from time to time that particular grunt which indicates a full stomach, I think we may be pretty sure they are being looked after well, and that our food is not being wasted. It will sometimes happen that one or two have not cleaned out their manger, and it is a warning that a little fasting is required. A short meal or two will generally restore the waning appetite ; if not, a pint of linseed oil, or a pound of Epsom salts may with advantage be given. If on the contrary, we nearly always find food left in all the mangers, depend upon it we have a careless or stupid feeder ; either the leavings are cleaned out and given to other cattle which ought to be eating less expensive food, or fresh food is thrown on that left in the manger, to the detriment of our feeding cattle, and therefore I would say, let him give up his place to a better man as soon as possible.

The Feeding of Sheep.

I am more and more convinced that sheep intended for the butcher should be liberally fed from birth, and as round this neighbourhood we almost all of us breed as well as feed our sheep, I do not think I shall be wandering from my subject if I give my idea of their management from the time they are weaned. We must bear in mind that if, by care and good living, we can make ten or eleven stone weight each of our young sheep some time in January, that is, at from ten to eleven months old—sheep full of flesh and good quality—we can keep a heavier breeding flock, and by that means make more mutton and also grow more wool than we could if, by less liberal living, we were unable to dispose of them before March or April, or, as is the case in many instances, even later. Now, how are we to attain so desirable an end? I believe only in this way—by not only preventing our lambs from losing flesh, but by doing our utmost to make them gain flesh from the very moment they leave their mothers. There is ordinarily not much danger of their losing condition before, because nature supplies the food most suitable to their wants. Still, even for two or three weeks before they are weaned, I would recommend a small quantity of pea-meal or oilcake dust to be given, just to accustom them to it; then as soon as they are weaned, which with me is generally done while folding on seeds, two ounces of cake or split peas each (I prefer oilcake) from that time until August, their other food consisting of grass, vetches, and lattermath clover—two kinds of food are best—then rape and vetches, or rape, until the time comes for them to be cautiously put on to turnips. Towards the end of August, or even before, unless the weather is very hot, I would add to the other food a quarter of a pound of cracked beans, and as the season advanced, increase by degrees the oilcake until it reached three-quarters of a pound if straw chaff be given, but if a fair proportion of good hay, half a pound. By such living, sheep may be brought to good weights, fat, yet with plenty of flesh, at eleven, if not at ten months old, without forcing so as to produce disease, and without extravagant living. I wish to speak of what may be commonly done. The total cost of the artificial food would be for the whole time 11s. 6d. to 12s. per head. As an instance, I can mention a lot of half-bred tegs, 120, sold by weight this year. Taking the average time, all were killed by the 3d or 4th February, and they weighed 78¾ lbs. each, or nearly 10 stone. These sheep had had artificial food as I have described, turnips and swedes, and straw chaff, with a very small admixture of trifolium hay. My opinion is, that for young animals flesh-forming food should be given as far as practicable, but we must be cautious that it does not interfere with their health. For instance, beans, I believe, contain more flesh-forming matter than oilcake does, yet practically we find the latter more suitable in dry hot weather than the former, because beans are too heating. Another advantage we obtain by thus liberally feeding our lambs from the first, and gradually increasing the food is, that we run less danger of losing them in the autumn, at which time there is often a great mortality, more especially if, as it is said, forcing them is commenced. Should we find this, or indeed in any case, I think it is very desirable, and certainly it is necessary if we buy sheep to feed, to give them a little alterative medicine. I gave all mine some last autumn, and I firmly believe with great advantage. I had the medicine from Mr. S. Matthews, of Lechlade, who has made the veterinary art his study, and has succeeded in producing a really valuable mixture. Of the certainty of our losing sheep out of those which have received a check or have been badly done, even with the greatest caution, I have spoken before; but with all kinds of sheep, care is necessary when we begin to give them swedes.

Swedes should be given at first in very small quantities, with plenty of chaff, and doubtless the plan recommended in that excellent pamphlet by Mr. Wood, viz., of carting a few common turnips to mix for the first few days would be attended with beneficial results. Just the same caution is again required in the spring, if we give our sheep mangold wurzel; chaff should be liberally supplied. I believe, however, that for sheep, one of the most valuable times for giving that root is with vetches in hot weather. My shepherd has often said it does them more good than corn. We generally store some near our vetch land for the purpose, if we can spare them, so convinced are we of the benefit arising from their use at that time. As regards vetches for fatting sheep, I prefer to cut them unless they are quite young, and consider the little and often feeding most necessary; if the weather be dry and hot, water should be plentifully supplied if there is no mangold, as sheep will not thrive at such times without some moisture, and we should be losing the whole value of this expensive crop. With regard to the fatting of lambs, it is on the one hand argued that to fat lamb is very wasteful and should be discontinued, while on the other hand many people argue that as by it a proportionately greater weight is made in a shorter time, it is advantageous to the producer and consumer alike. I think we should bear in mind that if weight is made, it is not of so useful or so wholesome a quality, neither does it go so far, weight by weight, as mutton; therefore it is a matter for serious consideration, in these times especially, whether, as a rule, fatting lambs should not be discontinued. One word I will say on fatting them, and, indeed, all I can say, for I have never, since I left Wiltshire, seen any fatted, or taken much interest in the matter. One spring when there were no turnip-tops, the shepherd we had with us advised my late father to fatten

100 lambs, from ewes which I believe he had bought. He was asked how he would do it? "Nothing green, and the ewes on swedes. Give me a little pea-flour and I can do it," the man said, and so he did. The mother's milk, with quite a small quantity of pea-flour given in covered troughs, made those lambs quite fat in May (the latter part), and they went out at a good price. In this neighbourhood, our rule is to fatten sheep on the land, not in yards; but as it is a practice to keep sheep in yards through the winter, I think it right to bring into notice, and would suggest, for the consideration of those who are or may be obliged to keep sheep in yards, the plan of pulping roots to mix with the chaff, or if cake or corn or both be given, the boiling of these and throwing the soup over it, instead of that of giving dry food. I am quite confident that had I done so last year, when from necessity I was obliged to keep sheep in yards, I should have been a great gainer by it. I tried a small quantity of pulped mangold with the chaff in the spring, and found that the sheep ate their food with greater avidity, and I believe if we could conveniently manage to mix a little pulped roots with chaff for all our sheep even in the fields, it would be of great advantage. I cannot, however, see my way to do that; it would be attended with considerable trouble and inconvenience, to say nothing of having to overcome prejudices in the attendants' minds. I may say that salt is a thing we generally use for our stock. We have for many years thought it conducive to their health, and we prefer sprinkling a little over their chaff, as it makes them eat it better. Of our nutritive foods, then, for sheep, we have not much choice. Barley is indigestible, malt too dear, too many beans tend to spoil the quality of the mutton, as in bacon, by making it hard, and there remain only linseed cake and peas, for I cannot say I like either cotton or rape-

cake. Speaking of malt, I would refer you to a letter of Mr. Williams, of Bayden, to the Chancellor of the Exchequer, in which he states that a Mr. Wentworth, of Enham, near Andover, sold at Weyhill fair, on the 10th of September last, 200 lambs, only nine months old, at 69s. per head. About a month before the fair, these lambs fell ill with the foot-and-mouth disease, and to endeavour to prevent their losing the high condition to which they had been brought, he gave them 1 bushel of malt per day, or about $\frac{1}{5}$th of a pound each. The consequence was that they immediately recovered their appetites, and made the price named, 69s. This fact speaks for itself. Again, Mr. Hudson, of Castleacre, has stated that 1 peck of malt per day would lay on more flesh than 14 lbs. of oilcake, or $1\frac{1}{2}$ pecks of barley, when given to cattle of 100 or 110 stone weight, other food being alike, and Dr. Voelcker's analyses of different samples of malt prove that a less dried and, as far as I can recollect, a less sprouted malt than is usually made, would be more suitable and wholesome as food for cattle than that at present made. The price of malt is, however, a denial to its use. Take Mr. Hudson's idea. He appears to consider the value of $1\frac{1}{2}$ pecks of barley equal to 1 peck of malt—the barley would cost at the most 1s. 6d., while the malt would be 2s., or 25 per cent. more. I am inclined to think, however, that the time is not far distant when we shall be able to use malt, unfettered by any restrictions, in the feeding of our general stock.

THE FEEDING OF PIGS.

With them, as with our other feeding animals, it is necessary that we should endeavour as much as possible to secure those which, while having an aptitude to fatten, are well furnished with lean meat. I remember sending some beautiful little porkers, as I thought, to London, and in return the salesman wrote, "Your pigs did not make the best price; they were nothing but dabs of fat!" I may be expected to describe the mode I would suggest as the right one for fatting pigs from the time that the stores are worth about 40s. each. In my opinion it is a mistake and waste to give them at that time no other kind of food than corn. I believe that pigs always do better with some green food or roots until the last eight or ten weeks before being fit for the butcher. For stores worth the price I have named, I believe that the cheapest food at the present time is mangold wurzel, with one pint of beans or peas daily, and a little barley-meal made very thin. I would then by degrees, as the pigs progressed, lessen the beans, introduce some pea-meal with the barley, and instead of raw mangold, give cooked, mixed with the meal; then, as they approach the fat state, withhold the mangold, and if barley is plentiful, the peas also, for nothing will make such good bacon as barley-meal. In the summer time vetches, lucerne, or any green food given to our stores which are about to be fattened saves a part of the corn which must otherwise be given, and is more healthy for them. In any case I am fully convinced that a part of the food for fatting pigs until just at last should consist of vegetable food other than corn, and boiled, if roots. Potatoes are best, if not too expensive; but if they are, swedes, mangold, or cabbage will answer. In the winter, and especially in a frost, pigs' food should be given slightly warm; and this reminds me of the great necessity there is for the feeder to judge accurately the quantity of food they will eat at a meal. I am happy to say that at the present time my men all know the importance of proper feeding, and act up to their knowledge; but I have many times, with some old men especially, had to complain of too much food being given at a time, and, as a consequence, of food left in the troughs. At the next meal an addition was made, and so on again and again; of course it could not have been so palatable to the pigs; they were never really hungry, and never seemed to enjoy their food. I have often asked the men this question: How would you enjoy your food, if, after having previously had more given you on your plate than you could eat, you were to see some fresh food placed on the same plate with your former leavings and offered to you again at your next meal? Would you not rather have a clean plate? So would pigs. However, they would not or could not see it, and it was only by having intelligent men who can understand such matters, and take an interest in their work, that I have been able to get my own way. I have said nothing as to the right time to sell stock, as, of course, every one must use his own judgment in such a matter. He may be influenced by many things to sell sooner, or, on the contrary, to hold longer than would be profitable, if we speak only of the state of the animals. As a rule, I believe that the proper time to sell is when they are fit to sell—that is when they are in that state in which they are said to die well, or in other words to have plenty of loose fat, etc. If they are killed before or after that time the butcher cannot afford so high a price per lb., because, in one case, the offal being light, he has not so much profit there, and in the other, he is, in order to satisfy his customers, obliged to pare off the over-abundance of fat, and sell it at tallow price.

Conclusion.

In conclusion, may I be allowed to say that we have for some years now been told to look to our stock for profit, and think less of corn. Late events have shown us that that also is a precarious source of profit. The dreadful disease which has destroyed so many herds, and brought poverty, disappointment, and sorrow to so many of our brother farmers, the no less fearful small-pox in sheep which has lately shown itself in Northamptonshire, and the scourge among pigs which last year was so prevalent; all should convince us that although we may have been for years past labouring to bring our stock to perfection, and endeavouring to carry out the most useful suggestions of modern science in our management of them, our hopes may in a short time be dashed away, and we may be left with nothing to show for all our labour. Our duty, however, is plain. Let us take every precaution to keep our stock healthy. Strengthen the hands of the local authorities, who are called upon to carry out the Acts of Parliament regulating the movements of cattle, by willingly suffering necessary inconvenience, and persuading others to do so. Urge upon our rulers the importance—the absolute necessity—of strict quarantine and watchful vigilance with regard to the importation of foreign stock, for our country is now suffering deeply from the neglect of that vigilance, for doubtless from abroad have come all these diseases. Let us remember also that we are in the hands of an all-wise Ruler—let us endeavour to have a loose hold on the things of this world, and to feel that our property is only a talent lent to us, so that if the loss of herds and flocks should overtake us, we may still be enabled with cheerfulness to bless the hand that may have taken away that which it alone had given.

AGRICULTURAL LABOUR.

BY

ELIAS PITTS SQUAREY,
ODSTOCK, SALISBURY.

PREFACE.

In the following pages I have attempted to trace the causes which influence the remuneration of agricultural labour in the various districts of England, and have endeavoured to show how the value and quality of that labour are in many localities affected by the action of the Law of Settlement. This age, which so wisely recognises the justice and policy of the principle that individuals should be allowed to buy and sell in what market and to what extent they may deem best, will surely admit its application to the removal of its one remaining exception, namely, the practical, though not the expressed, prohibition by the law of settlement of the workman to sell, and the employer to buy, his labour in a perfectly open market.

Viewing every labouring man as a possible future recipient of poor-law relief, the framers of this law, in the endeavour to insure the economic administration of such relief, have so trammelled the workman's resources, and have so impeded his abilities to support himself, that it has undoubtedly in some localities occasioned, and in many others increased, the evils which it sought to remedy.

As a tenant farmer, I cannot but look upon the solution of this question as finally removing all traces of the hitherto artificial position of agriculture,—whether a farmer wants much or little labour let him buy it at the market value, paying well for the skilled labour, while he naturally purchases the inferior at a cheaper rate. There is at present no reason to doubt the power in this country to absorb the small surplus population of our agricultural districts, and thus to convert the labourer, at present ill paid, and profitable neither to the country or to his employer, into a useful and independent man.

I can lay no claim to novelty or originality in much that I have written.

The press has teemed, from the seventeenth century downwards, with pamphlets having reference to, and suggestive of, remedies for a state of things obviously at variance both with policy and justice. The question was finally exhausted by the publication of Mr. Coode's able "Report to the Poor Law Commissioners upon the Law of Settlement" in 1851, and being cognisant of its bearing upon the interests of the employers and the workman both morally and economically, I have merely endeavoured to give a practical direction to the views of those who have examined or written on this subject before me.

To free myself from the charge of plagiarism, I may state that the principle of equalization of the poor's-rates, which appears hereafter, and which is nearly identical with that of Mr. Coode, had occurred to and been discussed by me some years ago. I can only congratulate myself that in this important point my views should so closely coincide with those of a gentleman so practically intelligent as Mr. Coode.

In conclusion, I would return a general expression of thanks to those gentlemen at whose hands I have received such valuable information as to the wages, etc., current in the counties of Dorset, Hants, Kent, Hertford, Essex, Worcester, Lancashire, and Middlesex.

ODSTOCK, *January* 1854.

AGRICULTURAL LABOUR.

THE principles which have hitherto regulated the wages of the agricultural labourer in the various districts of Great Britain, more particularly in those remote from the seats of manufacturing industry, have been often discussed, and their justice and policy frequently and freely debated. These inquiries and discussions have, however, too often arisen from, and been applied to, the mere party purposes of political accusation or defence, and consequently have not afforded such trustworthy evidence as might arise from a dispassionate examination of the whole case.

Little doubt can be entertained but that the value of agricultural labour would have followed the same laws of variation, as regards supply and demand, which govern the wages of the other industrious classes, did not some artificial restraint prevent it. The Law of Settlement, under any of its modifications, occasions this restraint; and although neither its original nor present intention is opposed to the migration of labourers from one market to another, yet its indirect operation has, with few exceptions, tended most powerfully to prevent such migration. Hence arises in frequent cases the establishment of arbitrary and conventional principles of remuneration.

In counties purely agricultural, a scale of remuneration based upon the value of corn has been acted upon for a long period.

The practice in most districts is to allow the value of a bushel of wheat, and 1s., 2s., or 3s. extra, as the weekly wages of an able-bodied married labourer.

During the depression of prices since 1848, this principle has not been closely adhered to; and, on the other hand, it is possible that if the prices of corn were to rise 40 or 50 per cent., the value of labour, if still dependent upon this arrangement, would not rise in the same proportion; the rule seems, therefore, only to be generally applied when the price of wheat varies from about 42s. to 60s. per quarter.*

During the summer, piece-work, in the form of mowing, turnip-hoeing, and reaping, enables the workman to increase his income, although the price of such work still depends upon the value of corn, before referred to.

For the six weeks during harvest, the wages are usually 2s. or 2s. 6d. per day for day-work, with certain liberal allowances of liquor, and in some districts the addition of food.

Wherever this system exists, there are certain subsidiary advantages accorded to the labourer, which are more or less useful, and may be clearly assessed at a certain money value. They consist in different districts of an allowance of so much land for additional garden purposes, the occasional entire sustenance of the labourer during certain work; the allowance of corn at prices irrespective of the market value, the carriage, and in some cases the gift, of a certain quantity of fuel. In many counties a daily specified allowance of liquor, and, in some exceptional instances, the keep of a cow, is given.

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* This suggestion, written September 1853, is confirmed by the rate of wages now (December 1853) current, under an advance of about 85 per cent. upon the prices of wheat given above.

In the counties of Wilts, Dorset, Hants, etc., the wages vary from 9s. to 10s. per week.

The number and value of these extras vary largely, but in many cases they are of considerable advantage.

It may be supposed that this principle of wages, fluctuating with the value of one of the chief articles of production, might have arisen from an early and apparently just desire to give the labourer a species of partnership, at all events an interest, in the manufacture in which he assists. There is a feudal, normal justice in according the value of a stipulated quantity of the article produced, as the compensation for the exertions of the labourer toward its development; but, however true this may have been in the early history of the adoption of this principle, its permanence has arisen from the fact that it has represented as nearly as possible the point at which a labourer with his wife, and an average number of children, could subsist without receiving pecuniary assistance from the parish.

Previous to the passing of the New Poor-Law in 1834, the number of his children was regarded as a plea for the workman receiving a certain defined money payment, in addition to his wages, from the parish to which he belonged. Since then, the labourer with a large family has either been occasionally in the workhouse, or by using his residence there as a threat, has obtained from the principal rate-payers higher wages than would be generally current under the application of this principle, or such adventitious assistance as they could most readily afford. Indeed a private conventional rating for the purpose of meeting the exigencies of particular cases of pauperism, arising from large families, and insufficient earning, still obtains in some exceptional parishes in Wilts and Dorset, and possibly elsewhere.

This arrangement of wages is not, however, of general application. In the neighbourhood of London, and of all other places which afford a large area for the employment of labour, it will invariably be found that the price is higher than in those districts remote from any but agricultural employment.

The average rate of wages for all farming operations in the former localities is about 20 per cent. higher than in counties purely agricultural.

It is apparent that if the value of labour is justly represented by the price of a certain portion of wheat, this principle would admit of general application ; but the examination of these foregoing facts indicates that it only occurs in those districts where wages are lowest, and where, from its adoption, it would seem that the employer had some leverage, which rendered its acceptance, on the part of the employed, compulsory and unavoidable.

The explanation of these different rates of wages for the same character of labour in various districts seems to be, that near the centre of manufacturing or other internal industry, the labouring population of the surrounding agricultural neighbourhood is partially absorbed, fewer hands are left to execute the work, and they, acting under the influence of the law of supply and demand, ask and obtain larger wages. On the other hand, those localities in England which exhibit the lowest rate of wages afford a remarkable and instructive instance of the applicability of the same law, although its effects are directly the reverse of the previous case. The extreme depression of wages occurs in those parishes which, extending over a small area, and with no internal sources of manufacturing employment, are, in proportion to their area, comparatively densely populated. The labouring population is consequently completely agricultural, and is principally occupied in the farms which are adjacent to, but not within, the boundary of their parish. Labour is here bought at the cheapest possible rate, as no remonstrance on the part of the workmen, or threat of leaving their service to go into the workhouse, can influence the employers, inasmuch as they would be chargeable as paupers to the parish in which they reside, and not to that in which they work. The labourers have therefore no alternative but the workhouse, or to accept such wages as the neighbouring employers choose to offer. This system has, of course, a tendency to depress the wages of the whole surrounding districts.

It may be asked why migration from these to more highly paid districts does not arise.

To a certain extent it does occur, but almost entirely amongst the younger and unmarried inhabitants; even with these there is the fear that if illness or pauperism overtake them, unless they have resided five years, they are liable to removal to the parish of their settlement, no matter what ties they may have formed, or how prejudicial to their interests such removal may be.

A careful consideration of these facts leads to the conviction that, although the wages of agricultural labourers are, through the agency of the law of settlement, usually dependent for all their fluctuations above the nearly minimum point of subsistence upon the arbitrary arrangement of the employers, yet that in some cases the principle of supply and demand overrules the operation of this law, and produces exceptions both above and below the average wages of the country.

The reduction of wages consequent upon the application of the principle of supply and demand does not militate against its justice, inasmuch as this effect is produced in particular localities through the law of settlement, which interferes with its broad and complete application.

It is worthy of note that wherever supply and demand regulate wages, subsidiaries in lieu of wages (to which previous reference has been made) invariably cease, and are resolved into fixed money payments.

Nothing more clearly indicates the eleemosynary character of wages in agricultural districts, or at all events the fact of their being only given as a protection against the greater costliness of increased poor-rates, than the existence of a different rate of wages for the married and single men, however incompetent the one, or skilful the other. This character is further indicated by the general uniformity in amount of the weekly wages of all married labourers (with the exception of carters, shepherds, etc.), irrespective of their various abilities and of their physical powers. This feature would seem to be so completely at variance with the employer's interests that its explanation is obscure, except upon the assumption that the incompetent labourer and his family cannot live upon less wages, and the more skilful one, not having an open market in which to sell his labour, cannot obtain more.

It would be difficult to conceive any arrangement more injurious in its application to the industry and habits of a peasantry than this which prevails, with some large and admirable exceptions, throughout all districts purely agricultural.

It has been customary, and with reason, to censure general unskilfulness and want of energy displayed in the ordinary farm-labourers, and with too much truth to assert that they present fewer examples of reaching a higher position in life than any other class of the community. The occasion of this peculiarity is of course a matter for speculation, and may in part be due to the operation of other causes, but the most important is doubtless the absence of any encouragement to improve. It is indeed a small premium upon industry when energy and idleness, skill and incapacity, are uniformly remunerated. The justice of these conclusions is strengthened by the fact that when agricultural labour is paid for according to supply and demand, and when, consequently, the uniformity of wages ceases, the operations are conducted with greater ability, the entire average skill of the whole class is raised, and, in fact, an improved character of labour developed.

This uniformity of wages has prevailed long enough to produce an effect which might have been predicted, namely, that the labourer, with few inducements to improvement round him, has so retrograded, that in many districts he is become absolutely worth no more than the rate of wages which he has ordinarily received.

In the counties where the lowest wages prevail, there are a few individual exceptions, in which the Law of Settlement ceases to produce injurious consequences. Thus the shepherds and carters in these districts are usually paid much higher wages than are current with the common workman. In the case of shepherds, their skill is encouraged and well paid for, because such skill being highly remunerative to the employer, it induces him to risk the consequences of the Law of Settlement, and the shepherd has thus an almost open market for his labour. Under the old modification of the law, however, it frequently occurred that this servant was by consent discharged for a few days or weeks, etc., so as to break the continuity of residence, and thus prevent his gaining a settlement in the parish in which he resided and worked.

A consideration of the foregoing facts will obviously lead to the inquiry why piece-work, a system so productive of industry,[1] so subversive of idleness, which, while it insures the economy of an operation, tends at the same time to increase the skill of the labourer, and consequently benefits both employer and employed, is not adopted in all operations where its application is feasible.

The answer is a complicated one. During summer, piece-work is universally applied to mowing, reaping, turnip-hoeing, etc., etc., and indeed to a number of minor labours which need not be here enumerated. The more quickly these operations are performed the better, and one succeeds the other so rapidly that the increased industry of one week does not cause a lack of employment for the next. At other seasons, however true the same economical principles may be, and however easy their application to the winter and spring labours of agriculture, the indiscriminate adoption of piece-work would result in great prosperity and large receipts at one period, and a dearth of employment and diminished income at another. If any new class of occupation could be obtained in the largely populated agricultural parishes, piece-work would undoubtedly prevail much more extensively than at present. In illustration of this position, instances are current where, during the winter, a labourer, although working by the piece, has not been allowed to thrash more than a limited quantity of barley per day,—a quantity less by 10 or 15 per cent. than his full industry could have accomplished.

The general application of piece-work would, in many districts, exhaust all the usual employment of the winter and spring months, long before the summer work could commence. Under the present system of settlement, during the winter months, a farmer does not say, "Here is my work, which do as quickly as possible,"—but, "Here are my labourers, for whom

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[1] See Cantrell's Paper on Task Work in this volume.

I must find employment; therefore (unless work of an unusual character arises) they must work by the day, or, if at piece-work, not too rapidly exhaust that source of employment."

It is the action of this principle which has so largely retarded the adoption of machinery for the performance of farm labour. It will be found to be applied chiefly on those farms where the labourers attached to the parish are limited, or where labour in the shape of improvement in draining, grubbing, chalking, etc., etc., has been extensively required. There can be no doubt of its general economy, and that under a free labour market it would be almost universally employed.

It may be asserted that there is room and occupation for all the hands whose labour would be displaced by machinery, in the extension of further improvements on the properties on which they work.

This is fully admitted, but there is generally some obstacle either on the part of the landlord or tenant to such improvement; otherwise, trusting to self-interest, it would be undertaken.

That the amount and quality of the work performed by one man for 1s. 2d. per day is often relatively dearer than that of another at 1s. 8d. or 1s. 10d. per day, may be safely asserted. It is difficult to institute either individual or general comparisons, so as to arrive at any correct conclusions, but an examination of the wages and of the cost of performance of piece-work in the highly-paid counties of Middlesex, Kent, Surrey, etc.; and in those of Dorsetshire, Wilts, Somerset, etc., would indicate in the weekly wages a difference of 25 per cent., but in piece-work a difference of only 8 per cent. in favour of the former counties.

As affected by the Law of Settlement, the interests of the employer have been yet only cursorily referred to. He is prevented by its operation from purchasing his labour in the best market in the same proportion as the labour is prejudiced in its disposal.

Being compelled, in common with his fellow ratepayers, either to support or to employ, whether profitably or unprofitably, all the labouring population who belong to his parish, the farmer has naturally done so at the lowest rate. It is not to be wondered at that the wages of those whom he might be willing to remunerate highly, as skilled good labourers, should soon sink into the lower rate common to others who are thus thrust on him, and it will be easily understood. Now, a master forced by the Law of Settlement to employ labour which he does not want, is driven by the same necessity to depreciate the value of that which he does want. Hence a rapid transition to a uniform rate of wages, with all its attendant evil consequences.

The low rate of wages which has been current in some agricultural districts has been the frequent occasion of political discussion, and while one party has affirmed its existence to be a disgrace to the employers, the other has endeavoured to palliate the fact by asserting the subsidiary advantages accorded to the labourer, and their consequent comfort and wellbeing. It may be questioned whether the payment of high or low wages is a matter either of censure or praise. In each case the employer is governed by self-interest, and in the former instance pays high wages because he cannot obtain his labour at a lower rate. In the latter the low remuneration for labour has arisen from the action of a law which has interfered with its equitable distribution, and which, as it rendered the employment or support of the labourer compulsory, allowed the employer to dictate his own terms.

That this reproach, however unjust, would disappear upon the removal of the relations which the Law of Settlement entails between the master and workmen of an agricultural parish, may be safely affirmed. Each employer would endeavour to hire such workmen as were skilled, honest, and sober, and would be consequently compelled to pay higher wages for them. The value of inferior and less trustworthy servants would be undoubtedly decreased, and for a time they would probably find a home in the workhouse, but as experience would teach them that a residence there was a charge on the country generally, not on a particular parish, and that, consequently, no small class of individuals was interested in finding them employment, they would endeavour to obtain work, and keep it, by improved conduct and greater industry. Nor is there any injustice in this depreciation of wages for inferior labour, more especially when it is remembered that its continuation depends simply upon the workmen themselves.

The bearing of the Law of Settlement upon the agricultural labourer and his employer has as yet been discussed only as affecting wages,—its operation upon the physical and moral condition of the labourer is equally injurious.

To explain this, it will be necessary to glance cursorily at what the Law of Settlement really is and has been.

It is needless to trace this law through all its phases, from its foundation in the earliest Saxon times, as a means of identity and protection, to the year 1662 (14 Carolus II.), when its object was to "prevent strangers from gaining a settlement, by giving authority to remove by warrant all persons coming to settle, dwelling in a tenement under the yearly value of £10, whom the parish officers or justices might consider likely to become chargeable."

The first amendment to this Act was passed in 1795 (35 Geo. III.), by which it was enacted, that no person should be removed until actually chargeable, and thus was taken away a large source of oppression and injustice. Since this date the whole character of legislation upon this important matter has been to modify the stringency of the Act of 1662. The last alteration made in 9 and 10 Vict., by making persons who have resided five years in a parish irremoveable, and chargeable, in case of pauperism, upon the common funds of the union instead of such parish, is an important boon to the labourer, and is an assimilation to the principle of a union settlement.

It is possible that the original Act of 1662 may have been successful in its object of putting down vagrancy, but little doubt can exist but that to it is in some measure attributable the largely increased pauperism of the succeeding years, and far more the decay of the independent character of the peasantry.

It will suggest itself to every mind, that under this system the interests of parishes become antagonistic. The aim of each is to limit the number of possible objects of parochial relief to such an extent as may merely satisfy its industrial requirements, and the pursuance of this object has developed in the course of time causes of moral wrong and degradation to the labourer, as injurious in their operation as the prohibition to dispose of his labour in the best market.

The most immediate consequence has been the partial destruction of cottages in those parishes where proprietors are few enough to allow a combination to secure this end, and in many others to prevent their erection in such numbers as to meet the wants of a naturally increasing population.

The first of these consequences occurs most frequently in parishes belonging to one or more proprietors which are in the neighbourhood of a town or large village, where the labourers so deprived of accommodation can obtain residences, and where the responsibility of allowing a tenant to gain a settlement is not individually felt. So long as the interests of the owners or their tenants are not injured by a want of labour, it is profitable under the present system to destroy the houses of those who may become chargeable to the parish in which they dwell. The application of the principle is necessarily limited by the absence of any neighbouring town or populous village capable of affording shelter to the ejected peasantry.

This antagonism of interest, this endeavour on the part of the parishes to shift their responsibility and pecuniary charges, may be merely an unintentional consequence of the Law of Settlement, as framed for the purpose of compelling each parish to support its own poor. But from the attempt, wherever feasible, of each parish to make its own poor chargeable on its neighbour, such evils to the moral and physical well-being of the peasantry arise as demand large and immediate remedies.

The fact of the overcrowded state of cottages in most of the agricultural villages is so generally admitted, its details and miseries have been so eloquently and truthfully reported, both by official as well as private individuals, that a mere enumeration of instances more or less shocking to the feelings of human nature would serve no good end.

If there be any doubters on this head, a reference to the reports of the Poor-Law Commissioners, a visit or appeal to the clergymen of any not exceptional agricultural parish, will furnish ample evidence of the existence of this state of things.

It may be urged, if better and more numerous dwellings were provided for the labourers, that they would not appreciate them, that they are wedded to their habits, and would wish for no other.

The true explanation would rather be, that the circumstances by which they have been surrounded have, with few exceptions, lowered them to their present state.

The anxiety of the labourers to get any cottage, no matter how mean, rather than be compelled to leave the village in which their work lies, and to reside in a neighbouring town or village, is the proximate cause of the overcrowded and too often dilapidated condition of their dwellings. They have the choice of two evils, either to accept the cottage in their own parish as it is, and be co-resident possibly with seven or eight persons where decently there should only be four or five, or the alternative of living in another district more or less remote, paying a higher rental, possessing fewer comforts, and with the terrible physical tax of walking daily five or six miles to and from the scene of their labour.

Is it to be wondered at that the labourer accepts the former alternative, and, seeing no hope of improvement, gradually accommodates himself to the circumstances by which he is surrounded?

There is no necessary connexion between labour and want of cleanliness, between comparative poverty and immorality, unless stimulated by such conditions as those referred to above, and before the peasantry are assumed to prefer discomfort to comfort, or the overcrowded cottage rather than the one where a decent propriety may be observed, it should be shown that their choice is a free one, and in no way consequent upon the action of a law external to themselves.

This deficiency of cottage accommodation is equally frequent in agricultural villages remote from towns. Here the labourer has not the poor option afforded him by the vicinity of a town, and he must either throw himself into the larger labour market of some distant district where it may be absorbed, which, if he has a wife and family, is a serious and speculative undertaking, or he must be content to remain the inmate of one of those overcrowded dwelling-places.

The fact that cottages of the most ordinary character, and built in the cheapest manner, do not in the rural districts pay a common rate of interest on the cost of erection, appears at first sight a strong argument against the construction of more. But the present rate of wages current in these districts obviously occasions the inability to pay a rent to compensate the outlay in building; for supposing that an able-bodied occupant of one of those overcrowded places had the option, by additional labour and consequent wages, to procure for himself by the payment of larger rent a superior and more comfortable residence, the experience of all time and persons proves that he would exert himself to attain it.

The question cannot be fairly argued whilst matters are in their present form. With few exceptions no choice exists, and the labourer is as much compelled to live in this frequently uncivilized condition as he is to work for his daily bread.

In the event of the labourer, through the impossibility of squeezing himself into any cottage in his own parish, becoming a dweller in a neighbouring town or village, his condition is in no degree improved. Should he fail to obtain occupation there (and from the character of the labour to which he has been accustomed the reverse would be quite exceptional), he would most probably work on some farm in the parish from which he is excluded. Herein lies his toil and wrong. He is compelled day by day, in all weathers, to walk the additional distance which his residence may be from the scene of his labour, varying of course with circumstances, the journey to and fro in many cases amounting to seven or eight miles a day. Let us picture him dragged from his bed at least an hour earlier than if he were living in the immediate vicinity of his labours, taking hurriedly the only warm meal which he can obtain until the evening, starting to walk three or four miles, and arriving by six o'clock, sometimes drenched with rain, to take his place at his accustomed occupation. The meal-times afford him the opportunity to consume his food in the state he has brought it with him from his distant home, but, unless through the kindness of his fellow-workman, he has no place of comfort wherein to eat it. His labours for his master over, before him lies his dreary walk home, which he too often reaches worn out and exhausted.

Another and perhaps deeper injury presses upon him, in that his wife and younger children are often entirely prevented from obtaining work by the additional exertion which its distance from home occasions, or if they do obtain it, it is so depreciated by this extra labour as to be diminished in value at least 20 per cent. if working by the piece. Eventually the remuneration is so reduced by the increased risks of illness, and general wear and tear of clothing, etc., that under the circumstances it is often barely worth the acceptance.

The mere physical sufferings and needless labour involved in such a life need not be enlarged upon; they are apparent, with numerous aggravating accessories, to any one who has inquired into the matter; and the picture here drawn is one that is applicable not to individual but to thousands of cases.

But apart from the humanity of the question, the generally more powerful consideration of its utter wastefulness and want of economy to the workman, to the employer, and eventually to the State itself, demands attention.

The workman's pecuniary position may be demonstrated to be proportionally worse as the rents of cottages in towns are higher than those in the country. The absence of any garden is another serious drawback, although the hours which are usually devoted to its cultivation would in these cases be absorbed by the journey to and from work. The additional exposure entails a greater expenditure of clothing and fuel, and considerably enhances the risks of illness. Indeed the most prevalent malady of the agricultural labourer is "a chill," invariably arising from exposure and damp clothes.

The drawbacks to his well-being are, however, quite independent of the injury to the gross income of the labourer. If piece-work prevails, and more or less it does so on every farm, then it is certain that his muscular ability and his hours of work are reduced in proportion to the distance he has to walk, and there is such proportional reduction in his income. If, on the other hand, labour is paid for by the day, it is quite evident that the employer, having the choice of two workmen normally equal in strength and skill, would select him who came to his occupation fresh, rather than the one who had six miles a day extra to walk.

In this latter case the diminished probability of being employed is perhaps the only immediate ill consequence. If day-work prevail, the labourer would receive the same wages as his fellow-workmen, and the loss arising from his partially exhausted powers would fall on the employer.

The consequence of this system of equal wages for unequal labour has been referred to before; and although one would not desire that the already suffering workman should endure the yet further penalty of reduced wages, yet it is clear that practically he is worthless, and that his employer, by paying him the same as his fellows, is offering them a premium to decreased exertion.

The employer's interest is equally affected by this waste of power and time, whether his work is performed by the day or by the piece. If by the latter, there is a tax on the appliance of the whole physical power of his men upon the work set them, which, as it prevents more being done, partially enhances its cost. If they work by the day the conclusion is obvious.

No statistics yet gathered will afford us any means of arriving at the number of workmen who are subject to these conditions. Hundreds of individual instances may be given where the distance walked daily has ranged from four to eight miles. If from this we deduct one mile as the distance which labourers resident near their work have probably daily to walk, it will leave three miles for these cases now under discussion.

This is equal in time to at least 1 hour per day, and supposing that a man work 300 days during the year, this will represent a loss of 30 days of 10 hours each, equal to 10 per cent. upon the whole period occupied in labour.

By what number this should be multiplied to represent the general loss of the whole country we have no personal means of judging. The number of cases in this or that parish, or, indeed, of any particular union, would not afford a fair basis of calculation, inasmuch as this injurious system scarcely obtains in those districts before referred to where the law of supply and demand rather than any artificial arrangement regulates the wages of labour.

It is no just answer that the rates of the parish of A. are reduced by the adoption of this practice, even at no cost to the comfort of the labourer, if those of the parish of B. are proportionally increased by it. It will also be admitted that the additional hour or hour and a half's exposure to the weather, and the coincident labour, entirely unrepresented by any reward or comfort, not only increase the probabilities of illness and death, but lay the foundation for disease in the form of rheumatism and other similar diseases, which permanently place a man on the relief list. Medical attendance, relief, and the support of the pauper's family during such periods are important economic reasons, apart from the humanity of the question, for the amendment of a law from out of which such wretchedness and misery arise. No means are open from which we can form any correct estimate of the amount of expenditure immediately consequent upon this phase of the question.

The absence of a right and amicable feeling on the part of the labouring classes towards their superiors has been often commented on and lamented. This is scarcely the place to discuss a subject arising from, and bearing upon, so many social matters, but foremost amongst the well-grounded causes of irritation and complaint on their part is the insufficiency of cottage accommodation. How far, unhappily, this feeling is deepened and aggravated by the destruction of cottages in close parishes, and the consequent eviction of the peasantry, may well be imagined by picturing to ourselves the bitterness of mind which such daily physical exertion, known and felt to be unjust and needless, would engender towards the authors of it.

The obvious original intention of the Law of Settlement, as appearing by every Act and amendment yet passed with reference to it, was, that each parish should support such poor as were settled in it.

As it was improbable that there would be any greater number of persons likely to become chargeable in one parish in proportion to its area and wealth than in another, this was clearly an equitable arrangement, and moreover insured a careful supervision of the expenditure of each parish.

But out of this apparently equitable adjustment arose an almost interminable litigation as to what was and was not a settlement—as to who had and who had not gained one.

The cost of this litigation forms an item of £70,631 on the average annual expenditure for the relief of the poor of

£5,542,110 for the four years ending 1844. Viewed pecuniarily, this needs no comment, and it only faintly represents the miseries and vexations of the 32,099* persons probably affected by the consequence of this enormous expenditure.

The tendency of this arrangement, resulting from the Law of Settlement, was to induce each parish to regard a labouring inhabitant likely at any future time to become chargeable, as something which was to be got rid of, no matter where it went; and if through any quibble of law, or by the practice of any deceit, the parish authorities succeeded in shifting their responsibility by thrusting him upon a neighbouring parish, the triumph was complete.

Amendment after amendment was passed in the endeavour to simplify the meaning, and to mitigate the lamentable consequences, of this law; but as long as the principle remains in force that chargeability in one parish may be transferred to another, so long will the interests of parishes be antagonistic—so long will it be profitable to them, where feasible, to limit their scope for the pauperism by the destruction of cottages.

It may be asserted that the Act of 9 and 10 Victoria, cap. 66, sect. 1, for making paupers resident for five years in any parish irremoveable, and throwing their relief upon the common funds of the union, neutralizes to some extent the ill-consequences above referred to.

As far as the interests of the parish are concerned in which the pauper resides, this may be admitted, as the whole assessment of the union bears his support instead of itself, but the parish to which he originally belonged, and from which he has been excluded, has, though a diminished, still an immense interest in pursuing the same system upon his fellows, inasmuch as it is contributing only its quota, probably a very small one, to the general fund for the pauper's relief, instead of maintaining him entirely from its own rates.

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* See Ninth Annual Report of Poor Law Commissioners.

To the labourer the benefit of this Act is very great; it removes any disposition on the part of the parish in which he may wish to reside to remove him, inasmuch as it has a diminished interest in driving him away. He has his chance of a wider labour market, and if he be a good workman is certain to command constant work and fair wages.

The advantage to the employers is, however, only on one side. They are certainly enabled by it to choose their workmen from a wider district, and are under no apprehension that, by the employment of a new inhabitant, they are introducing a possible recipient of their rates; but it does not provide them with any remedy against the pauperism of those whose labour is displaced by that of the new immigrants. Such displaced labour is certain to be of the very worst character, and is consequently not likely to be sought for by other employers. It therefore remains a dead-weight round the neck of the parish to which it belongs, and either betakes itself to the workhouse in its endeavour to spite the ratepayers, or is employed as a matter of necessary economy by the parish generally.

The operation of this amendment of the Law of Settlement has been seriously injurious to many towns to which migration had set in from the agricultural villages in the vicinity on account of deficient cottage accommodation. That a parish which has received the benefit of the labour of a man for five years, should support him in the event of pauperism, is theoretically a just dogma; but that the town where the pauper has not been employed, and where he has been merely accommodated with a house which the law has made it the interest of the agricultural parish to refuse, should become liable to support him, is a crying and practical injustice.

In many cases the increased expenditure in such towns from this cause has been perfectly astounding, and they have no method of checking the increase of this class of paupers.

As far, however, as the operation of this Act leads to a union settlement, it is highly advantageous to both employers and employed.

Its failure consists in this, that whilst it affords employers an open market in which to purchase their labour, it is still compulsory on the parish to provide employment or sustenance for any workmen so displaced.

What good purpose then does the Law of Settlement subserve which has induced and still justifies its retention? There are two answers to this—1st, That by it the expenditure of each parish in the relief of its poor is supposed to be watched over by its own officers, and consequently economized.

Wise and valuable as the economy may be, yet it is questionable whether it is worth all the consequences which are supposed to spring from its observance, and whether the interests of the commonwealth at large, though at the expense perhaps of particular parishes, would not be better secured by some new and simple arrangement.

It may be justly asserted that where wages, governed by supply and demand, are paid in proportion to ability and skill, the population are not thrown into that indiscriminate mass of pauperism characteristic of those districts in which the operation of the Law of Settlement is most felt, and where, consequently, equal wages without reference to individual capacity are paid. The vigilant watchfulness of hundreds of overseers is no compensation for any principle which tends to pauperise a whole peasantry.

The additional expenditure in the relief of the poor, resulting from the destruction of cottages, with the attendant ills, and the consequent double pauperisation of those towns and villages where the evicted labourers reside, is a most important obstacle to the general economical working of the Poor Law.

Let us trace how far the individual interest of each parish is protected under the present system. The absolute local control of the expenditure for the relief of the poor of each parish was removed by the passing of the New Poor Law, which transferred such control to the board of guardians.

The supervision of the authorities of each parish extends to this, that if A., B., or C., being paupers, apply for relief, either on account of insufficient earnings, illness, or other cause, the guardians, or their relieving officer, will ascertain what their means and position are, and upon a report of those facts the board of guardians, as an independent body, adjudicates. Now the experience of every guardian indicates that a really good relieving officer takes and fully discharges this portion of the responsibilities of an overseer; and although this proper attention may in some measure arise from the vigilance of the parochial authorities upon the relieving officer himself, yet sufficient men are found who perform these duties as zealously without as with this overlooking.

Under no circumstances can the decision of the board be influenced by the interests of any parish except as it is represented by its guardian, and his power to limit the expenditure of his parish is negatived, or at all events qualified, by the judgment of his fellows. If a general or county settlement obtained, the individual ability of a guardian, either towards retrenchment or extravagance, would be still further comminuted. It would indeed be only a further extension of the present principle.

The statistics of those parishes which approach most nearly to a union or other settlement afford instructive information upon the economy or otherwise of general as compared with individual supervision. The following Tables, given in Mr.

Coode's able Report on the Law of Settlement, illustrate the fact that the expenditure of poor-rate per head on population is less in those parishes which have been consolidated for the purpose of a union settlement than in the other parts of the counties in which they are generally situated, and over which, up to 1832, the old parochial vigilance might be expected to be in full vigour.

TABLE of the Expenditure of Ten Unions for Rating compared with the Expenditure of the Ten Counties in which they are respectively situated :—

Incorporations and Counties.	Date of Incorporation.	Number of Parishes.	Population in 1831.	Expended for relief of the Poor, Year ended Ladyday 1832.	Rate per head of Expenditure on Population.	Population in 1841.	Expended for relief of the Poor, Year ended Ladyday 1842.	Rate per head of Expenditure on Population.
				£	s. d.		£	s. d.
Bristol, ...	1696	20	59,074	26,492	8 11½	64,266	18,580	5 9½
Gloucester, ..		382	387,019	172,562	8 11	431,318	133,308	8 2¼
Exeter, ...	1697	22	28,242	9,007	6 4½	23,312	7,161	4 7
Devonshire, ..		472	494,478	225,299	9 1¼	538,460	194,192	7 3¼
Norwich, ...	1712	43	60,505	25,524	8 6¼	61,848	20,489	6 7½
Norfolk,......		727	390,054	318,413	16 4	412,664	184,114	8 11
Canterbury, ...	1727	17	13,694	7,897	11 6¾	15,435	5,319	6 10¾
Kent, ...		423	479,155	364,381	15 2½	548,337	206,715	7 6½
Bury St. Edmunds,	1747	2	11,438	7,839	13 8½	12,538	7,119	11 4¼
Suffolk, ...		509	296,317	279,490	18 10¼	315,073	138,729	8 9½
Chichester, ...	1763	11	8,270	4,965	12 0	8,512	2,576	8 0¾
Sussex, ...		315	272,340	284,467	20 11	299,758	147,427	9 10
Salisbury, ...	1770	3	9,388	6,348	11 5½	9,490	4,358	9 2¼
Wiltshire, ...		334	240,156	199,088	16 8¾	258,733	137,338	10 7½
Oxford, ...	1771	11	18,038	6,298	7 10¼	18,154	4,562	5 1¼
Oxfordshire,..		286	152,156	138,684	17 11½	161,143	78,148	9 8
Southampton, ...	1773	6	18,670	5,962	6 4¾	27,108	7,136	5 3¼
Hampshire, ..		334	314,280	230,886	14 8¼	355,004	140,997	7 11¼
Glossop,..........	1838	2	9,631	1,202	2 6	14,576	1,381	1 10¾
Derbyshire, ..		310	237,170	81,403	8 10¼	272,217	60,972	4 5¾
Total of the Incorporations,		137	234,853	100,534	8 6¾	263,231	78,661	5 11¾
Total of the Counties,		4,092	3,263,125	2,292.593	14 0½	3,588,265	1,421,938	7 11

If the total expenditure for England and Wales had been reduced in the same proportion as these unions for rating bear to their respective counties, it would have been—

In 1832—£4,313,918 instead of £7,036,939 ; saving £2,723,051 in the year.
In 1842—£3,712,736 instead of £4,911,498 ; saving £1,198,722 in the year.

The deduction to be drawn from this Table must be qualified by the consideration of the different condition and circumstances of the population in the towns consolidated under Gilbert's Acts, and that of the surrounding districts with which they are compared.

Amongst the chief objections to the New Poor Law of 1834, was the belief that the control of the parochial funds would be largely interfered with, and a consequent extravagance introduced which would be fatal. The event was, however, a reduction of expenditure in the first year of £919,330, in the second, £1,876,228, and in the third, £2,876,410.

From whatever causes arising, this saving indicates, at all events, that economy may perfectly exist with a more extended, as well as with an individual and local management.

The second objection to the alteration of the Law of Settlement consists in the removal of the interest which parishes now have to employ any superabundance of labour existing therein, and, until we analyse the circumstances, it seems a strong *primâ facie* one.

Let the reader investigate the history of the first parish he remembers where these circumstances are found, and he will discover that such excess of labour has arisen simply from the operation of the Law of Settlement.

There is no normal reason why the labouring population should increase in one village more than in another, and it may be fairly inferred that only labourers enough for the industry of each locality would be found in it, if no artificial restraint in the form of this law existed, and if the destruction of cottages in the close parishes had not compelled the inhabitants to seek dwellings wherever they could be found.

Men do not willingly choose as residences those places where three or four months of the year are passed in the workhouse, on the parish road, or in some other occupation provided for economic reasons by the parochial authorities, the remuneration for which is certain to be at the lowest possible rate.

The remedy for the numerous evils of the present system, and the object to which the foregoing remarks are directed, are to be found in the expansion of the parochial into a union or county, or possibly a national settlement.

This expansion involves, however, some serious contingencies. Chief amongst these is the equalization of the poors-rates of all parishes, with the view to the levying of one uniform common rate, either for such union or county, or for the entire area of England and Wales.

If such equalization took place, all rateable property would be at once beneficially or injuriously affected, in proportion as the present rating of the parish in which it was situate was above or below the average. The approval of the ratepayers in the parishes which had benefited by this change would not compensate for the just complaints and opposition of those whose interests suffered. Nor would it be any answer to such complaints to say that their expenditure, whether much or little below the average rating, was the result of an unjust and impolitic law. The fact that they bought or rented their property proportionally dearer as their poor-rates were light, gives them a right to demand that the transition from the present to the average rating should be gradual, not immediate.

To remove, therefore, any supposed injury either to the yearly or to the purchaseable value of any rateable property, it is proposed that the equalization of the poors-rate should be consummated in forty years, in ten epochs of four years each; the average expenditure of each parish for the three preceding years being taken as the average rate of such parish. Thus the general expenditure remaining the same, each parish every fourth year would pay $\frac{1}{10}$th of the difference between such average rating and the average rating of the union, county, or other district of settlement; $\frac{1}{10}$th increase if the rating were below the average; $\frac{1}{10}$th decrease if it were above it.

The assimilation would thus be completed at the end of forty years.

The period of forty years over which it is proposed to extend the equalization of the poors-rate may be objected to as too distant, and it may be urged that a practical injustice would arise by reducing its termination to thirty years, inasmuch as the fee-simple of all rateable property may be currently reputed to be worth no more than that number of years' purchase. But it must be remembered that this increase, however gradual, of the poors-rates of those parishes which are now below the average rating of the entire area of England and Wales, would not commence at the expiration of thirty years, but would come into immediate operation. Under any circumstances it is a change which would be compulsory, and any supposed injustice to the landowners and ratepayers of such parishes is rendered utterly remote and undefinable by adopting the longer term of years. On the other hand, those parishes whose expenditure is above the average rating, and to whom the equalization will be beneficial, ought to be, and would be, well satisfied, that a principle was laid down by which their especial burdens would be mitigated, and, however distant, that they were assured of their approach to a period of final equalization.

A Table sufficiently extensive to illustrate this principle is subjoined, wherein the rateable value, as well as the expenditure for the relief of the poor, in four parishes, is assumed to be different. The principle of variation every four years, and eventual equalization, will be traced in the figures of each column.

Name of Parish.	Rateable Value.	Average Expenditure for Three Years.	Rate per £.	Average Rate of the Four Parishes.	Difference between Parish and General Rate.		$\frac{1}{10}$th of each Difference.			
					Below.	Above.	In the £.	On Rateable Value.	To be Added every Fourth Year.	To be Deducted every Fourth Year.
	£ s. d.	£ s. d.	s. d.	s. d.	d.	s. d.	d.	£ s. d.	£ s. d.	£ s. d.
A.	1166 0 6	83 16 1½	1 5¼	....	11 ·112	....	1 ·1129	5 8 1½·4	5 7 1½·4	....
B.	374 15 0	89 0 0¾	4 9	....	....	2 4¼·473	2¾ ·473	4 9 4¾·8	....	4 9 4¾·8
C.	2480 0 6	392 13 4¾	3 2	....	....	0 9½·483	¾ ·483	9 18 9¾·7	....	9 18 9¾·7
D.	1966 4 0	142 9 3¼	1 5¼·55	....	10¾·967	....	1 ·099	9 0 1 ·9	9 0 1 ·9	....
	5987 0 0	707 18 10½	....	2 4¼·517	....	....	....	....	....	....

Name of Parish.	1855.	1859.	1863.	1867.	1871.	1875.	1879.	1883.	1887.	1891.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
A.	89 4 3 ·42	94 12 4½·8	100 0 6¼·2	105 8 7¾·6	110 16 9½·2	116 4 11 ·6	121 13 0½·84	127 1 1¾.62	132 9 3¾·65	137 17 4¾·9
B.	84 10 7½ ·2	80 1 2¾·4	75 11 9¾·6	71 2 4¾·8	66 13 0 ·9	62 3 7 ·2	57 14 2 ·9	53 4 9¼ ·6	48 15 4 ·8	44 5 11¼·8
C.	382 14 6¾ ·5	372 15 8¾·6	362 16 10¾·9	362 18 1 ·2	342 19 3 ·5	333 0 5 ·8	323 1 7¼ ·8	313 2 9¼ ·4	303 3 11½ ·7	293 5 1½·3
D.	151 9 4½ ·9	160 9 5¾·3	169 9 7 ·7	178 9 8¼·6	187 9 9½·5	196 10 9¾·4	205 10 0 ·3	214 10 1¼ ·2	223 10 2½ ·9	232 10 3¼·8
	707 18 10¼ ·8	707 18 10¼·6	707 18 10¼·4	707 18 10¼·4	707 18 10¼·4	707 18 10¼·8	707 18 10¼· 8	707 18 10¾ ·8	707 18 9¾ ·5	707 18 9¾·8

The parish of B. represents one of the exceptional cases referred to in page 230, where a low rateable value with a large area of pauperism has enhanced the poors-rate to an exaggerated and unnatural extent.

Under this proposed system the injury to any present interest is very minute, and the charges contingent upon its adoption, although gradually increasing, are so remote that the value of property, either for a lease or for sale, would not suffer to any appreciable extent. But even on the supposition that in exceptional parishes the rates would be largely increased, it may be fairly argued that under the present system, from one or other of the causes referred to before, such parishes are and have been contributing less than their proper quota to the relief of the poor.

The supposition that the amount expended for the relief of the poor would be continuous and annually the same is however quite untenable. The causes affecting such expenditure depend on circumstances which are constantly varying, and it is probable that the change of the Law of Settlement here proposed might for a year or two increase, though it would afterwards tend to diminish such amount. To meet, therefore, any expenditure beyond that which the average contribution of the past three years would afford, it is proposed that the rateable value of the whole union should be assessed at one uniform rate in the £. On the other hand, if the expenditure were reduced below such average, each parish would have its contribution proportionally lowered by one uniform reduction in the £ on the rateable value of the whole union.

The rateable value of parishes is subject to important variations from the introduction of new property, such as railways, new buildings, etc., on the one hand, or from the decay of a particular branch of manufacture, or by similar causes on the other. The average expenditure for the past three years with the fluctuations approaching to or receding from the average rates of the whole district of settlement (subject to the increase or decrease referred to above), must however remain as a fixed charge upon such parish until the expiration of the forty years.

Any advance on the rateable property of a parish would consequently effect a *pro tanto* reduction in the rate in the £; any decrease on the rateable value would, on the contrary, proportionally enhance it. To illustrate the principle of altered rateable value, let us suppose that the parish of A., whose assumed rateable value in the former tables is £1166, 0s. 6d., suffers a general reduction in value of £150, thus reducing the amount on which the assessment is levied from £1166, 0s. 6d. to £1016, 0s. 6d. If this reduction in value occurred in 1867, when the progressive charge would be £105, 8s. 7¾·5d., the rating in the £ on £1016, 0s. 6d. would be 2s. 0¾·6d., and if this depreciation in value continued to the year 1891, the rating would then be 2s. 8½·2d. After this date it would fall to the assumed average amount of 2s. 4¼·517d., subject however to the changes of rateable value, and to the fluctuation in the general expenditure for the relief of the poor.

On the other hand, if the rateable value of the parish of C. increased from £2480, 0s. 6d. in 1855 to £2800 in 1871, the rates would then be 2s. 5¼·5d. in the £ instead of 2s. 9½·3d., which it would be if the rateable value had not changed.

That the rateable value will increase rather than decrease over the whole area of rating is the most probable assumption, although exceptions productive of inequality will occasionally appear.

The inequality of the basis upon which the rateable values of the different parishes are calculated is, under the present system, a most important matter, although its consequences and its unequal pressure are not generally recognised by the ratepayers. If the rateable value were only applied for the purposes of the poor-rates for such parish, it would be quite indifferent on what basis it was assessed if the ratepayers were satisfied with their respective proportions, but when it becomes the standard for the levy of the county police and other general rates, the public have a deep interest in its uniform and equable assessment. The necessity for such eventual adjustment under the alteration here proposed is obvious, and its immediate application would not affect the principle of equalization as suggested in the foregoing Table.

This inequality of rateable value would, if removed, considerably decrease the apparent present expenditure in the £ for the relief of the poor, as there is little doubt that the majority of the rateable values in agricultural parishes are assessed at too low a standard.

Whether the entire abolition of the Law of Settlement, and the consequent conversion of England and Wales into "one broad parish," would be productive of more benefit than the extension of the present area of parochial into union or county settlements, is a matter that needs much discussion and careful inquiry. In either of the latter cases, the misery consequent upon removals, the tendency to insufficient cottage accommodation, and the limitation of the labour market, both for employer and employed, would be considerably mitigated. On the confines, however, of either of these areas of settlement, disputes and questions of removal might occur.

The probability of litigation would, however, be lessened in proportion as the interests affected were general rather than parochial.

The entire abolition of the Law of Settlement, on the other hand, removes all objections of this character. Wherever pauperism overtook a man, there he would receive relief. Neither union, parish, nor individual ought to have any interest in refusing or evading this charge, provided there is assurance that the recipient really requires it. The able-bodied pauper himself would much earlier cease to be one, whether his pauperism arise from illness or want of work. In the former case, he is not harassed by the prospect of removal. In the latter, he feels that no individual or parish has any interest in removing him from the workhouse, but that if work is to be had in any part of the kingdom, it depends upon himself whether he will be employed or not.

The agricultural labourer in the lower-paid districts of England would have no obstacle to prevent his migration to a higher labour market, and the employer would have the option of buying skilled labour at its natural market price. A premium would be offered to the best workmen, in the legitimate shape of increased wages, whilst the inferior character of labour would be bought at its worth, until it found its interest to consist in greater industry or ability.

Cottages in localities most convenient for each farm would then be regarded as much necessities as the position of the barns, stables, etc. A farm on which the labourers resided, with no fear of increased poor-rates to result from such residence, would be worth more to a tenant than one where his labourers had to walk a considerable distance to arrive at their daily work.

The question with a landowner would be, not whether his cottages paid a fair interest on the cost of their erection, but how far his property was decreased or enhanced in value to a tenant by their absence or insufficiency.

If the labour of more persons than those actually resident on an estate were likely to be permanently required, cottages would be built for them; with an open market before them, the labourers would not be content to be part-occupiers with another family of a cottage barely sufficient for the decent accommodation of one, and thus this most pernicious consequence of the existing system would be avoided.

The management and general conduct of the workhouse and the election of the officers need undergo no material change. It may be objected that guardians, having no direct and personal interest, would never attend the meeting of the board, and the distribution of relief would be consequently left to the decision of the officials.

The non-attendance of some guardians may be safely predicted, but the honest and economical discharge of many other public duties by men whose interests are social rather than individual, affords a fair guarantee that this most important charge would not be neglected or abused. The area for management and local arrangement may clearly remain unaltered. In fact, the only change in these departments would be, that the officials would be spared the trouble of keeping a separate account of expenditure for each parish, and that, consequently, the labour of the clerk and master of the union would be so far diminished.

That the value of all kinds of manual labour has had a tendency upwards during the past few months, and that such increased value is, from the operation of many external causes, likely to be permanent, is a fact of great importance with reference to the alterations here proposed, inasmuch as such rise in wages is an evidence of the public ability to absorb and employ more labour. The comparative equalization of wages which would obtain under a perfectly open labour market would probably be the occasion of still further enterprise and commercial activity, whilst the average well-being and comfort of the labouring classes would, under any circumstances, be certainly equal, if not superior, to their present condition.

The temporary increase of the poor-rates, possibly consequent upon the very important changes of the Law of Settlement, will be far more than compensated to the ratepayers by the lessons of self-reliance, true independence, and consequent dread of pauperism which it would inculcate upon the labourer; while the option of the employer of purchasing labour, of whatever character he may choose, at its natural and market value, the justifiable expectation that the rate of wages will be higher, because the workman would be more industrious and skilful, and the certain mitigation of much of the wretchedness which now needlessly surrounds the agricultural labourer, in conjunction with the fact, that the question at issue is far more social than political, may sanction the hope and belief that the Law of Settlement, proper and necessary, it may be, in the seventeenth century, may soon be so dealt with as to meet the altered circumstances and requirements of the nineteenth, with benefit to every class affected by the change.

TASK WORK,

BY

CHARLES S. CANTRELL,
RIDING COURT, DATCHET, BUCKS.

WITH A

PREFATORY NOTE

BY THE REV. JOHN CONSTABLE, M.A.

TASK WORK.

When it is stated that labourers receive wages varying from 8s. to 10s. a week, out of which they are expected to pay rent and rear their children, philanthropists may well view with pity their condition,—it seems one so hopeless.

How are men to satisfy the mere animal wants of themselves and children, much less provide clothing, medical attendance, and education? A state of things in which so many thousands must remain in a position requiring the pecuniary help of those above them cannot be a healthy one, must be degrading to the class, and injurious to the whole community.

But the question arises, Is all this true? Can it be justly said that in any large area of our country the whole earnings of a family are no higher than £26 a year? I believe that it cannot.

There is a repugnance (shared even by the comparatively wealthy) to allow others to know the amount of their earnings, and the poor are singularly sensitive to all inquiries which seem to have for their object the investigation of their pecuniary position. I remember a case eminently illustrative of this remark. A relative of my own, suddenly struck with a benevolent intention, asked his overseer to ascertain the names of those out of the men in his employment who had money in the savings-bank; his object being to make a grant by way of encouragement to all who were acting prudently. Only a small percentage of the savers gave in their names; the others lost the gift—which in this case was equal to the money saved—through a repugnance to reveal their pecuniary state. It is with the greatest difficulty that any facts can be ascertained. Every inquirer who has had to deal with such questions shares this experience. The clergy, however much they may know of the condition of the poor, have yet, as a body, but an unpractical acquaintance with the real earnings of their flock. It is only the masters, the employers of labour, who can correctly estimate the joint earnings of a family; and with them also the knowledge is frequently vague, from their not having kept a proper labour-journal. I believe that it would be greatly to their advantage as a class, if they would periodically with exactness ascertain the earnings of their labourers; it would enable them to rebut the charge, which is so frequently, and as I believe very generally ignorantly, made, that the agricultural labourer is in so miserably depressed a condition that it is useless to preach to him the duty of providing for the education of his children, or of considering himself as one having the same social and domestic obligations which belong to the classes above him. I was more than ever drawn into this train of thought, when I was asked last winter to meet with others at Mr. John Ravenhill's house, near Heytesbury, for the purpose of discussing, in the presence of the assistant commissioner, the great problem of the day,—the education of the rural population; it was then that I discovered the vagueness of our information as to the real earnings of the labourer and his family, the conflicting opinions, the well-nigh impossibility of arriving at the truth.

Some of the most respectable and the oldest of the inhabitants were examined by Mr. Norman, the assistant commissioner, but he could not get beyond the statement that 12s. a week was the very extreme limit of the able-bodied labourer's earnings.

I did not believe this, nor do I, where the individual is healthy, earnest, and industrious. There are allotments in

Mr. Ravenhill's parish, and by conversation with some labourers, I ascertained that they would not give up their quarter acres for £5 a year; so that here at once was another 2s. added to the stated weekly wages.

It can never be a healthy condition when large masses of the population are utterly incapable of fulfilling the duties given them by God; and what can be more of a duty than the rearing and educating of their children in a manner suitable to their social state?

The very prosperity of England is almost a *prima facie* proof that the agricultural population is not in a degraded state. Why they are willing to be thought so, and so treated, is a problem difficult to solve; but why the clergy and the wealthy should frequently exert themselves to perpetuate this belief can only be a matter of wonder.

Self-respect should surely be the foundation-stone of a true character, and that is a wrong estimate of humanity which considers that the poor can ever occupy with force, and to a good purpose, the position assigned them by God, until they recognise, act upon, and enjoy that individuality which they share in common with the highest in the land.

I should be willing that a portion of capital, which is only accumulated labour, should be assigned to their assistance, in the erection, for instance, of schools, and in the purchase of apparatus; but I should rejoice to see the day when the main burden of the education of their children was borne willingly, yea more, gladly, by themselves. How can a system prosper in which the proportion of expense borne by the parents is so miserably small? I am inclined to believe that if statistics were obtained, and the amount of the earnings of the entire agricultural population compared with the amount spent by that same class in education, the latter would be found to be not ¼ per cent.; in fact, year by year, we are trying to make it less; and therefore it is not a matter of surprise to hear even educated and enlightened men assert that they can see no greater results for the education now produced in their expensively managed schools, than what came from the bygone village-dame's efforts. Education, like everything else, to be valued must be the product of effort; in general we care for nothing that is easily procured; it is a law of our nature, and we cannot alter it.

It is difficult to assign limits to the action of that Divine statement, "It is more blessed to give than to receive." It is applicable to the poor as well as to the rich, and to things temporal as well as things spiritual. It is more blessed for the parent to be an instrument, yea, the instrument, in the giving of the child's education, than the mere recipient of bounty.

It has been with the view of ascertaining the correctness or otherwise of this position, that I determined to collect statistics from the labour-books of agriculturists, and I have to thank Mr. Charles S. Cantrell for the readiness with which he complied with my request, not only to be made acquainted with the items of his labour-journal, but also to be allowed to publish them for the benefit of others.

A very cursory glance at the Tables will show that while men frequently earned as much as 4s. and 5s. a day at task-work, they seldom earned as small a sum as 2s.

In the following tables, the fourth column, headed Constant of Labour, records the portion of a day or days taken for each particular work; for example, against the first item in 1853, thrashing red wheat by flail at 3s. 8d. per quarter, the constant of labour is 1·833 a day.

The advantage of knowing the constant of labour is, that the cost of the work in any district may be ascertained by multiplying this constant by the day wages; for instance, in the above case the old man received only 2s. a day, but suppose that you wished the labourer by the task work to earn 3s. a day, you would multiply 1·833 by 3s., which gives 5s. 6d., the price per quarter at which you would have to let the work to secure this result.

WAGES PAID FOR LABOUR at Riding Court, Datchet, Bucks (near Windsor, Berks), by CHARLES S. CANTRELL.

1853.—*Day Wages,* 10*s. per Week.*

Kind of Labour.	Prices Paid.	Men's Earnings per Day.	Constant of Labour.
Thrashing red wheat by flail,	3s. 8d. per qr. including tying straw,	2s. an old man,	1·833
Pecking and screening gravel in a pit, . . .	3d. per cubic yard, measured after being screened, . .	2s. 2d., .	·115
Thrashing winter beans, flail,	1s. 6d. per qr. with tying straw,	2s. 3d., .	·6
Haybinding, . . .	2s. per load, of 36 trusses, or 18 cwt.,	4s., . .	·5
Thrashing white wheat by flail,	8s. 6d. per qr. with tying straw,	2s. 2d. able men,	1·616
Do. barley, do.	2s. per qr. do. do.,	2s. 4d., .	·857
Do. black oats, do.	1s. 4d. per qr. do. do.,	1s. 10½d. to 2s.,	1·7
Day Wages, 12*s. per Week.*			
Covering up heaps of trimmed Swedes with straw and earth in the field—a good crop,	2s. per acre, . .	2s. 10d., .	·705
Pulling and trimming do.,	8s. per acre, .	Men, 2s., . Women, 1s. .	4· 8·
Spreading dung, 12 tons p.acre,	1s. 6d. per acre, . . .	2s. 3d., .	·6
Tying up fagots, . .	2s. 6d. per 100, .	2s. 6d., .	1·
Grubbing old hedges and banks,	8d. per pole, . . .	2s. 4d. to 2s. 6d.,	·285
Breaking up wood, . .	4s. per stack of four cubic yards,	2s. 5d. to 2s. 8d.,	1·65
Thrashing small beans, .	1s. 4d. per qr., ...	2s. 3d., . .	·592
Thrashing Poland oats, .	1s. 6d. per qr., . .	3s. 9d., . .	·4
Hedging and ditching, .	6d. per pole, .	2s. 2d. to 2s. 5d.,	·23
Thrashiug winter oats, .	1s. 6d. per qr., .	2s. 10d.,	·53
Mowing grass, . .	5s. per acre, no beer, .	5s. to 5s. 6d., .	1·
Do. clover, . .	4s. do. do., ...		·8
Hoeing Swedes and turnips,	10s. for two hoeings, . . .	3s. to 3s. 6d., .	3·3
Thrashing wheat by flail,	2½d. per truss of straw, 36 lbs., .	2s. 8d.,	·07
Turning dung heaps, .	¾d. per cubic yard, . .	2s. 10d. to 3s. 4d.,	·022
Moving soil in a bank, .	2d. per do. . .	2s. 10d.,	·058
1854.—*Day Wages,* 13*s. per Week.*			
Thrashing barley by flail,	2s. 6d. per qr., with tying straw, .	2s. 6d. to 2s. 11d.,	1·
Do. black Tartar oats,	1s. 8d. do. do., .	2s. 8d to 3s.,	·625
Filling mould from bank into carts, and levelling it, .	2d. per cubic yard,	2s. 6d., .	·06
Tying up barley straw from thrashing machine in two bands, . .	1s. per load of 36 trusses,	3s. to 4s., .	·3
Hoeing winter beans, .	4s. per acre, .	3s. 6d. to 3s. 10d.,	1·14
Do. wheat, . .	5s. do.,	2s. 7d. to 3s. 5d.,	1 955
Do. beans, rows only, after being horse-hoed, .	2s. 6d. do., ...	2s. 6d. to 3s., .	1·
Pecking and throwing gravel into heaps without screening,	3d. per cubic yard measured in the solid, before pecking, .	3s. 6d. to 4s.,	·071
Cutting tops off beans to destroy black lice, . .	2s. 6d. per acre, . .	4s. 3d.,	·588
Thatching ricks, . .	1s. per square of 100 feet, .	5s.,	·2

In the year 1854 I commenced thrashing by steam, with fixed machinery, and after several trials to ascertain what the men *could* and *would* do, I fixed the following scale of prices, which I have continued to the present time, and which are satisfactory to master and men :—

Kind of Labour.	Prices Paid.	Men's Earnings per Day.	Constant of Labour.
Wheat,	2s. per load for the straw tied up in *two* bands for sale, 1s. 9d. per load,	Men, 2s. 6d. to 3s. 8d. Women, 1s. to 1s. 3d.	·8 2.
Barley and oats,	3d. per load (72) for bands,	6s. man and boy,	·05

These prices include all the labour of unloading the waggons as they are brought to the barn, handing the sheaves to the feeder, a boy carrying away the corn as it comes from the thrashing machine, keeping the chaff clear, moving away the racket or cavings, tying up the straw in two bands, and stacking it in a shed adjoining the barn.

The cost of thrashing at the before-mentioned prices, and also including engineer's wages (3s. 6d. per day), coals, oil, and beer (1 pint to each man per day), but exclusive of interest on outlay, varies according to the yield of corn from straw; thus—

Wheat, 2s. to 2s. 6d. per quarter,		Winnowed from the chaff; it is finished by hand-power.
Barley, 1s. 4d. to 1s. 8d.	do.	
Oats, 10d. to 1s.	do.	

1855.—*Day Wages 2s. 2d. per day.*

Draining 4 ft. deep with one-inch pipes and collars, Drains 33 feet apart, total cost £5 per acre,	1s. per pole for digging out drains, laying pipes, and filling in—soil a light loam on a hard pan of gravel full of springs,	2s. 8d. per day in the winter,	·375
Digging a pond and wheeling soil out,	4d. per yard cube,	2s. 6d.,	·13
Lopping trees and tying fagots,	5s. per 100,	2s. 7d.,	1·935
Hoeing wheat,	4s. per acre,	2s. 6d.,	1·6
Mowing clover,	4s. per acre,	6s.,	·6
Do., grass,	5s. do.,	6s. to 6s.,	·83
Trimming low cut hedges both sides and topping,	½d. per pole,	2s. 6d.,	·46
Reaping wheat and oats,	10s. to 15s. per acre,	5s. to 6s.,	2· to 3·
Mowing barley, heavy crop,	6s. per acre,	6s.,	1·
Pulling and trimming mangold-wurzel,	8s. to 9s. per acre, according to crop—say 30 tons per acre,	2s. to 2s. 3d.,	4·
Pulling and trimming Swedes,	8s. per acre—say 20 tons,	2s. to 2s. 6d.,	4·
Covering up do. with straw and earth in the field,	1s. 6d. per acre,	2s. 6d.,	·6
Sawing elm-trees,	4s. per 100 ft.,	6s. to 6s.,	·8
Do. ash and oak,	4s. 6d. do.,	” ”	·9

1856.—*Day Wages 2s. 2d. per day.*

Thatching a waggon-house,	3s. per square of 100 ft.,	5s. to 6s.,	·6
Hoeing winter beans (rows only) after horse-hoeing,	2s. 6d. per acre,	2s. 6d. to 2s. 8d.,	1·
Hoeing oats and wheat,	4s. per acre,	3s. to 3s. 6d.,	1·3
Hoeing turnips after tares,	6s. per acre, once hoeing,	2s. 9d.,	1·8
Hoeing bean stubble,	5s. 6d. per acre,	2s. 2d.,	2·53
Thrashing beans by flail,	1s. 4d. per quarter,	2s. 7d., to 2s. 11d.	·576
Unloading dung from railway trucks to dung-carts,	2d. per ton,	3s.,	·05

1857.—*Day Wages 2s. to 2s. 2d.*

Turning and mixing together mould and lime in a heap,	1½d. per cubic yard,	2s. 6d.,	·05
Digging ditch, making bank, and planting quick,	9d. per pole,	2s. 6d.,	·3
Cutting chaff by wheel machine, hand-power,	1½d. per truss of 56 lbs.,	2s. 6d.,	·05
Shovelling out dry ditches,	2d. per pole,	3s. to 3s. 4d.,	·05
Hoeing potatoes, rows only,	3s. per acre,	2s. 6d.,	1·2
Rending, or splitting out oak-posts and rails (rough),	3s. 6d. per 100,	3s. 6d.,	1·

Haymaking, carting, and ricking by soldiers, at 2½d. per hour and beer.

1858.—*Day Wages* 2s. *per day.*

Kind of Labour.	Prices Paid.	Men's Earnings per Day.	Constant of Labour.
Making hurdles from withy poles,	4s. 6d. per dozen,	5s.,	·9
Mending do.	2s. do.,	5s.,	·4
Flagging heavy crop of wheat to prevent its going down,	3s. per acre, *2s. 6d. would be enough.*	3s. 6d.,	·857
Hoeing potatoes, rows only,	2s. 6d. per acre,	2s. 4d.,	1·07
Spreading lime for turnips.	1s. 6d. per acre,	3s. 5d.,	·44
1859.—*Day Wages* 1s. 10*d. per day. Average price of Wheat* 40s. *per qr., Barley* 32s. 10*d.*			
Spreading street manure,	1s. 6d. per acre on meadows,	2s. 4d.,	·642
Hoeing beans, rows only,	2s. per acre,	2s. 6d. to 2s. 8d.,	·8
Hoeing peas,	4s. ,,	3s. to 3s. 4d.,	1·33
Hoeing wheat,	4s. ,,	3s. to 3s. 4d.,	1·33
Pecking up peas,	3s. ,,	3s. 3d.,	·923
Paring and trimming corn ricks,			
On square stands 16 ft. squares,	1s. 6d. each,	....	·6
On round bottoms 20 ft. diam.	1s. each,	2s. 6d.,	·4
1860.—*Day Wages* 2s. *per day.*			
Grubbing an old hedge-row, with large elm-trees growing in it,	Grubbing 1s. per pole,	....	·413
	Throwing trees, 2s. 6d. each,	2s. 5d.,	1·034
	Tying fagots, 2s. 6d. per 100,		1·034
	Stacking roots, 1s. per cubic yard,	....	·413
Sawing timber,	Elm, at 4s. per 100 feet,	5s.,	·8
	Fir, at 3s. 6d.,		·7
Digging old bank,	4d. per pole,	2s. 8d.,	·125
Paring old turf in meadow,	20s. per acre,	2s. 5d.,	8 275
Burning do.	20s. per acre,	3s.,	6·666
Mowing grass and clover,	a heavy crop, 5s. 3d. per acre,	5s. 1½d.,	1·024
Thrashing old beans,	by the truss of 36 lbs., 1½d. per truss,	3s. 4½d.,	·037
Breaking and stacking wood,	1s. per cubic yard,	1s. 9d., the men being idle,	·571
Spreading manure,	1s. 6d. per acre,	2s. 10d.,	·529
1861.			
Sawing and splitting wood,	1s. per cubic yard	2s. in short days,	·5
Cutting clover into chaff by wheel machine, hand-power,	1½d. per truss of 56 lbs.,	2s. 2d. to 2s. 4d.,	·057
Thrashing black Tartar oats by flail,	1s. 6d. per qr.,	3s.,	·5
Hoeing beans,	4s. per acre,	3s.,	1·333
Shovelling out ditch,	1½d. per pole,	3s. 6d.,	·035
Hoeing wheat,	4s. per acre,	3s., 3s. 4d., 3s. 6d.,	1·3, 1·2, 1·14
Mowing grass,	4s. 6d. per acre,	7s. every good steady man,	·642
1862.			
Thrashing beans by flail,	1s. 6d. per quarter,	2s. 3½d.,	·654
Turning dung heap,	¾d. per cubic yard,	3s.,	·02
Mending corn sacks,	1½d. each.		
Flagging wheat,	2s. 6d. per acre,	2s. 4d., 2s. 6d., 3s.	1·07-·833
Pulling and trimming Swedes,	8s. per acre,	2s. 8d.,	3-·375
Covering do. with mould,	1s. do.,		
Pecking and screening gravel,	3d. per cubic yard, measured after it was screened,	3s.,	·083
Thrashing peas by flail,	2s. per qr.,	2s. 5d., 2s. 7d.,	·827

1863.—*Day Wages*, 12*s. per week.*

Kind of Labour.	Prices Paid.	Men's Earnings per Day.	Constant of Labour.
Spreading dung between ridges for potatoes, . . .	20d. per acre, . .	2s. 10d., . .	·58
Hoeing potatoes (rows only),	2s. per acre,	2s. 11d., .	·685
Do. mangold-wurzel flat,	4s. do.	3s. 6d.,	1·142
Bunching do.	4s. do. (too much), .	4s. 2d., . .	·96
Do. do.	3s. do.	3s., .	1·
Soldiers, haymaking, .	2½d per hour, and beer.		
Thrashing ears of wheat after the straw was drawn, and cut off for making bonnets,	3s. per qr. by flail, .	3s. 3d.,	·923
Thrashing beans by flail,	2s. per qr., including winnowing,	2s. 4d.,	·857
	1864.		
Hoeing peas by hand, *rows only*,	2s. per acre, . . .	3s., 3s. 2d.,	·66
Horse-hoeing between rows,	cost 1s. per acre.		
Earthing up peas for gathering,	3s. per acre, . . .	3s. 4d. to 3s. 8d.	·9
Turning dung heap, . .	5s. 8d., of 1d. per cubic yard, .	3s., .	·017
Mowing clover, .	5s. 6d. per acre, one set of men,	5s. 6d., *sober*,	1·
	Another do., .	4s., *drinking*,	1·375
Pecking peas haulm after gathering, . . .	3s. per acre,	4s.,	·75
Trimming cut hedges both sides,	½d. per pole. .	3s., 3s. 4d., 3s. 6d.	·013-·011
Thrashing wheat by the truss, tied up in one hand, .	2d. per truss, .	3s. 3d., .	·051
	1865.		
Sawing timber, ...	Elm, 4s., Oak, 4s. 6d., per 100 feet,	4s. to 5s.,	1·-·9
Trimming round corn ricks,	1s. each for 20 feet diameter,	3s. 3d.,	·307
	1866.		
Cutting quick hedge, and cleaning ditch, .	4d. per pole, . .	....	·083
Cutting hedge (only), .	3d. do., . .	4s., .	·062
Hoeing wheat, ...	4s. 6d. per acre, .	3s. 6d. to 4s., .	1·28
Digging land for potatoes, .	3d. per pole, .	2s. 10d., .	·088
Thrashing a small quantity of rough chaff wheat by flail, and tying up the straw, ...	4s. per qr., . .	3s. 1d., . .	1·3
	1867.		
Pecking and screening gravel measured in the "solid" before pecking, . .	4d. per cubic yard,	3s., .	·11
Thrashing ears of wheat after the men drawing straw for bonnets, . . .	3s. per qr., ...	2s. 11d. to 3s.,	1·028-1·
Hoeing wheat, . .	4s. per acre, . .	2s. 6d.,	1·6

Mowing grass and clover by machine, say 8 acres per day:—2 men, 3s. 6d. each; 2 or 4 horses, 10s.; beer, 12 pints per day, 1s. 6d. = 18s. 6d., about 2s. 4d. per acre.

1868.

Kind of Labour.	Prices Paid.	Men's Earnings per Day.	Constant of Labour.
Packing gravel, throwing it into a heap, and *not* screening it,	2d. per cubic yard, measured after being thrown, .	2s. 8d.,	·071
Hoeing wheat, ...	4s. per acre, ...	3s. to 3s. 6d., .	1·33-1·14
Thatching hay and corn ricks,	1s. per square of 100 feet, . .	5s., . . .	·2
Thatching straw ricks, . .	9d. do. do., . .	5s., .	·15
Hoeing potatoes (rows only),	2s 6d. per acre,	2s. 10d., 3s., 3s. 3d., .	·88-·77
Hoeing mangold-wurzel,	3s. per acre, rows only, . .	2s. 4d., . .	1·285
Cleaning mud from a brook, 700 cubic yards, .	Day work, 2s. 6d. per day, and 1 pint of beer, cost 2½ per cubic yard, . . .	....	·083
Pulling and trimming turnips,	7s. per acre, .	2s. 4d., .	3·
Making withy hurdles, .	4s. 3d. per dozen,	....	1·062
Mending do., .	2s. do.,	4s.,	·5

AVERAGES.

	Day.
Hoeing wheat, at 4s. per acre, in five different years, . .	1·302
Spreading manure, at 1s. 6d. per acre, in four do. do., .	·569
Sawing elm timber, at 4s. per 100 feet, in three do. do., . .	·816
Picking and screening gravel, at 3d. per square yard, in 2 do. do.,	·099
Mowing grass per acre, in four do. do., . .	·872
Mowing clover per acre, in four do. do., .	·96

RURAL EDUCATION

AND THE

EMPLOYMENT OF WOMEN AND CHILDREN IN AGRICULTURE.

BY THE

REV. JOHN CONSTABLE, M.A.,

PRINCIPAL OF THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER

RURAL EDUCATION, AND THE EMPLOYMENT OF WOMEN AND CHILDREN IN AGRICULTURE.

Rural education embraces a consideration of what it should be, as regards quality; and how it should be obtained. If the present facilities for education are inadequate, how are they to be increased? Supposing a rate made, is compulsion to be adopted towards the poor? And then, again, as regards the restriction of the employment of women and children in agriculture, the question arises, How far is such employment injurious? Do facts call for legislative interference? And then, the extent and nature of this interference. It may be remarked, at the outset, that people are pretty unanimous that education is a good thing, and that the children of agricultural labourers should be educated; but the moment we use this word "educated," we are instantly sensible that scarcely a dozen persons who accidentally meet on any occasion mean the same thing by the word. Some think of education for the poor as knowing how to do this or that; others, as an acquaintance with what is called the "three R's;" others, as a more extended knowledge, embracing history and geography; while another large class cannot apply the word to any system which is not based upon and incorporated with religious teaching. Now, it is almost hackneyed to say that education is the training of mind and hand, so that mind and hand may best fulfil the duties imposed upon them in the sphere of life in which God has placed the individual; and yet, stale as it is, it cannot be too often repeated: for beside steaching the essentials of every education, reading, writing, and arithmetic, the object should be to cultivate judgment, reflection, self-reliance—qualities, in fact, and habits. "Men may supply well or ill in later life the want of acquired knowledge, they may accommodate their habits and thoughts to the necessities of a changed position, they may develop their natures in ways wholly unexpected; but one defect can hardly ever be made good when the time of youth and early manhood is past, or, if made good, it can be so only as a result of painful and singular effort,—the want of habits of steady application and industry."—(Lord Stanley's Rectorial Address at Glasgow). Stating this, I may at once remark that I am opposed to the attempt which has been so often made of forcing upon the young a large amount of what is called useful knowledge, such as history, geography, and the like. If these subjects are capable of being made the vehicles, or, as we might term them, the roots for the production of the real fruits of true education—well and good, use them; but if they are merely additions, cast them aside. From my own experience I feel certain that everything can be done which is necessary for the class we speak of by good sound instruction in reading, writing, and arithmetic.[1] I know no subject that in my judgment and experience has been so misunderstood. Years ago I felt sure that disappointment would overtake the Government scheme; and I was led into this from perusing the inspectors' reports, and from estimating the standards which some of these gentlemen placed before themselves. Highly educated men, who never had had the training of any but the best intellects in the land, they could not estimate the material of the ordinary village school. I remember, in one case especially, a first-class inspector lamenting that in examining in decimals, although those examined could do what was set remarkably well, he was surprised and grieved to find that they were unable to give him reasons for the work performed. An inspector writes: "The habit of following in an intelligent manner the steps of an arithmetical operation, and of reasoning upon the truths involved in numbers, would give to the students themselves a training in accuracy of reasoning which the papers that I have lately revised show that they sadly lack."

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[1] Mr. Henley, in reporting on the subject of moral education, says:—"In Glendale I found, almost without exception, that the children and young persons could read and write and do plain figures more or less well, but sufficiently for their position; and though many were unable to answer simple questions in history and geography, still they had the elementary groundwork to build upon for the future. As regards the wider and more important question—the training of the future agricultural labourer in such habits as may make him an efficient farm-servant, I have already endeavoured to show that this, the main object of a child's education, is attained; and that, apart from the mere instruction of the mind, the working people are

Why, I will engage to prove that this complaint might be applied with justice to nine-tenths of the honour-men at Cambridge. The philosophy of numbers is one of the last things a student either reads or masters. Not long ago I read in the report of a meeting held in one of the southern counties, that a speaker, and one occupying a leading position as an educationist, advised "that they should require some certificate, or some other means should be taken to ascertain, before they intrusted a person with the care of an implement which they knew might injure him for life, whether his knowledge of the nature of it was sufficient to make him competent

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so brought up as to be useful to themselves and others, free from crime, and able to avail themselves of any opening which may offer to benefit their condition."

to manage the implement he was about to use." Why, those who know anything practically of education are aware that this kind of knowledge is, of all kinds, the most difficult, and of the highest order. Consider those who use the microscope, or, to descend to a more agricultural illustration, those who look through a surveyor's level or theodolite: how little do they, in general, know of the theory of these instruments! This worthy gentleman is, perhaps, himself not very *au fait* at the mechanism of his own timepiece, and yet I imagine he can take care of it. The requirement alluded to appears to me about as reasonable as if the consumption of food by a person were forbidden till that person knew the mechanical principles involved in the action of arm, fingers, jaw, the chemical principles in the digestion of food, and the physiological principles in the formation of muscle and bone from the blood. It is enough for the majority of persons to know how to eat and what to eat. But even assuming that the requirement is reasonable, that such knowledge is desirable, I am far from believing that it could be imparted. We at the Agricultural College, who have been trying to do it for years with the more matured intellects of men, know, to our sorrow and confusion, the small results usually secured. It would be well, however, if there were introduced into village-school teaching a little more work with the eye and hand than is usually attempted. The hand and eye are to the labourer the organs upon which his skill greatly depends. Free-hand drawing and mechanical drawing are subjects easily and inexpensively taught, and these, combined with the three fundamental subjects, would afford an excellent rudimentary training. The results of even a little attention, such as is given at the College, are singularly surprising and encouraging.

DESIRE OF THE POOR FOR EDUCATION.

The poor do, to a considerable extent, appreciate education. They cannot fail to see that the educated among themselves advance. The attractions which large towns offer to the educated, and the facilities for locomotion, all tend to give the labourer an idea of the value of knowledge,[1] and hence it happens that we constantly are assailed with the assertion that education renders youths dissatisfied and restless. The Hon. Mr. Best, at a meeting held at Basingstoke, remarked that "he could never get hold of a boy unless his head was so thick that the schoolmaster could drive nothing into it." I hold that the poor do value education, and are willing to pay for a good article. From my own experience, I can assert that, poor as many districts are, there are few in which good schools might not flourish. It was my lot to be settled for five years in a remote part of this country, the character of which I will give you from an extract of Mr. Fraser's Report (A 32):—"The physical, social, and educational condition of the labouring class appeared to me to be low. Many cottages which I saw in the parishes of Newent, Linton, and Taynton are simply unfit for human habitation. There are large areas nearly destitute of schools, or only provided with inefficient ones; and in the wild tract of country round Mayhill there resides a population, probably upwards of 1000 in number, wild, and almost savage in their habits, who seem to lie entirely out of the pale of civilisation. I do not know when I have felt more depressed, or more conscious of the difficulties that surround this great question, how to elevate the condition of the rural poor, than after my return from a drive of inspection which I had been taken by a medical gentleman, whose practice lies in this district, and in which I had seen type after type of social life almost degraded to the level of barbarism. The houses of the people are widely scattered, the lanes and field-footpaths in winter sometimes are ankle-deep in mire, the schools often inconveniently situated." Now, what did I find when I took up my residence in Upleadon, a parish situated in the union of Newent? A dame-school and a few scholars assembling in a small cottage occupied by the clerk. Until funds could be procured, I built a loft over my stable, in which I soon had the pleasure of seeing a group of eager scholars. Before long a good school was built, which supported a master and mistress, and I left it flourishing in 1854. By what means sustained? Why, to a great extent by the pence of the scholars—at least the parents did not hesitate to pay 3d. a week for the education offered, and the funds from this source, together with the contributions from the farmers resident in the parish, made a sufficiency for an efficient master and mistress. Now let it be borne in mind that this occurred in a parish in which no clergyman had resided till one year before my arrival, in which the total population did not exceed 280, and the acreage 1200. It would be weak to generalize from this one, although strong, case; but when I can say that the same experiment was repeated very nearly in Hampshire, and with similar results, you will pardon me for drawing your attention twice to my own experience.

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[1] Of the total increase in the population of England and Wales during 1851 to 1861, which amounted to 2,000,000, nearly one-half is to be found concentrated in London, Lancashire, and Durham; and two-fifths of the new population in those places consist of emigrants from the agricultural counties (*Fraser's Mag.*, April 1869). "Go where one will, one finds the sons of farmers and labourers among the most useful of our town population" (*Ibid.*) It is in the course of one generation that the proportion of the population employed in agriculture has diminished from one-third to one-tenth: in 1831 it was 28 per cent., in 1861, 10 per cent.

When I entered on the management of the parish of Upham, in Hampshire, a well-cared-for parish, with a resident rich squire, and having been superintended by an opulent and efficient rector forty years, I found, under the direction of a mistress, a school, which owed its existence and its support mainly to the late rector's bounty. Starting on the assumption that a good article is worth paying for, with the consent of my rector, the payment of the children was raised from 1d. to 3d. and 4d., and once more, with the contributions of the more wealthy residents in the parish, I succeeded in establishing a master and mistress in the district. The point urged in connexion with these two cases is, that parents are so sensible of the value of a good school that they will make a struggle to pay even a high fee for the education therein. You could not imagine two parishes more opposite in their antecedent conditions; in the one, a resident, wealthy, pains-taking rector, backed by liberal landowners, with a population whose wages ranged up to 15s. a week; in the other, no resident clergyman, no squire, and wages as low as 7s. and 8s. a week, and yet in both of them a school successfully established on the broad principle that whatever is worth having is worth paying for, and that the duty of educating their children is as binding on parents as that of feeding them. But if people will persist in assuming that the labouring class in this country is quite destitute of one of the instincts natural to us all, that they have no knowledge of self-interest,—if people will take it for granted that God, who gives children to the labourers, gives, at the same time, the duty of rearing and properly educating those children into other hands,—it is not a matter of wonder that failure so often crowns the efforts of those who try to subvert the Divine order of things. The words of Canon Brereton are in perfect harmony with my own convictions. He says, "I feel it difficult to understand how he (Canon Girdlestone) should fail to perceive the injury that is done to the independence of the English labourer, by thus stepping in between him and his child, and encouraging him to cast upon others one of the first duties that belong to him, as an English and a Christian parent." I would direct your attention to the sequel of that part of Mr. Fraser's Report which I have just read respecting the union of Newent:—"Mr. Ricardo is an entire believer in the sufficiency of the attractive power of an efficient school. Parents have quite intelligence enough to appreciate its value; the children themselves are drawn to the teacher, under whom they feel the pleasurable sensation that they are making progress. The incumbent of Upleadon, though he has a fairly efficient school under Government inspection, taught by a mistress only, finds that he cannot retain his bigger boys there; they are drawn off by the superior attractions of Mr. Ricardo's school at Pauntley, though the one school is close to their doors, the other lies at a distance of two miles." This school of Upleadon, remember, is the one established and left flourishing with a master and mistress in 1854, and as far as I know with no truants running away into other parishes. Nor does Mr. Ricardo stand alone in this view. Authority after authority could be quoted in substantiation of what is urged. Mr. Fraser, the Assistant Commissioner for Norfolk, Suffolk, Essex, Sussex, Gloucester, writes (x 27), "There is fully an equal number of parishes in which the parents are most anxious to get the best education for their children which is within reach." Mr. Henley (Northumberland and Durham) says that "there is great zeal for education shown by the agricultural labourers in the Cheviot Hills and Northumberland. Weather or distance does not seem to affect the attendance where the teachers are good." Mr. Stanhope

(Lincoln, Nottingham, Leicester) says that in the three counties he inspected "the demand for education among the labouring class is very active."

Mr. Portman (Cambridge and Yorkshire) is able to say that "as a general rule the better class of labourers are beginning to see the evils resulting to their children from the loss of schooling consequent on field-work at so early an age, and will gladly forego, if possible, the weekly earnings derived from their labour." In speaking of small occupiers of four or ten acres, he says, "As a rule these men are desirous of giving their children as much education as they can." He instances a case in Bilsdale, North Riding, "in which children come two and a half miles, and three miles, up and down the dale, over a bad road, and where the master said he had 40 to 50 children at school in winter when the snow was lying deep on the ground." Mr. Norman's report of Northamptonshire is not so satisfactory. He says that as a general rule neither parents nor employers are willing to make any sacrifice to obtain an education for the children (E 26). "No doubt when asked whether they value education, almost all labourers will say they do, but it is quite clear that they do not attach any such importance to it as to induce them to make a sacrifice to obtain it; the indifference is not universal, some labourers do really value education." Having carefully read Mr. Culley's (Bedfordshire and Buckinghamshire) Report, I do not see that he alludes to the disposition of parents towards education. Evidence indeed is not wanting to convince any unprejudiced person that the wide-spread opinion of the degraded and enslaved condition of the agricultural labourer is utterly unfounded; "we can," as Canon Brereton remarks, "only attribute to the strange unkindness of good and kind men, that will not let us look on the labourer as one of ourselves, and expect from him the feelings and consequent duties of any other good man, the existence of these views."

THEIR ABILITY TO PAY FOR EDUCATION.

But notwithstanding this, although the poor might be willing to pay for a good article if left free to do so, and not fondled as a horse or lap-dog, it is quite possible that they may not always be able; indeed many tell us that there are districts where they cannot pay. Be it so, what then? Do not the rich need help? It is a question whether Oxford and Cambridge could be sustained as they are if all their endowments were removed. Look at Eton, Harrow, Rugby, all our great schools: do they not seem to tell the same tale, namely, that education is so expensive a thing that it needs wealthy subsidies or it will languish; that is, that the payments of those being educated would never be sufficient to keep the whole scheme in efficient working? I know there are those who say that "although the public schools have doubtless taken their origin from educational endowments, it is not on that side that they are important to the country; such vitality as they possess is in truth derived not from but in spite of their endowments,—by the free action of the much-despised commercial principle represented by the head-master, as opposed to the antiquated traditions represented by authorities who preside over the endowments," and point to King's College, London, Marlborough and Cheltenham Colleges, as institutions flourishing upon the payments of the youths, without external aid of any kind. But however true and sound this may be, and I do not dispute the position, for I believe it to be in the sense in which it is referred to unassailable, it is still a question whether we should find many of the best intellects dedicating themselves to the severe work of tuition, if there were not some counterbalancing advantages;

if large emoluments and social status were not secured by the endowments received from our ancestors. All capital is accumulated labour, and endowments are simply a certain portion of the capital of the country, voluntarily assigned by the owners to a definite kind of expenditure—in the case of education, to promote it by lessening its cost and increasing its rewards. However, it ill becomes those who are in the possession of endowments to grudge aid to the poor. It may be a question whether education from the highest to the lowest ought not to be allowed to follow the laws of supply and demand,—whether endowments, appropriated to the use of any who are able to pay for education, are not in the long-run injurious to the cause they seemingly aid; but it ill becomes those who are willing to be be benefited by at least a questionable system, to grudge to the poor, who are acknowledged to be unable to bear the expense of education, and who consequently may well be considered in an exceptional light, some help. Indeed, we know that the very strongest advocates for free action in education, as in trade, who consider that on general grounds education is out of the scope of State interference, have yet been taught to believe that if the poor are to be educated at all it must be by other agency than the parents. Since the acceptance of the Revised Code, primary education is fully established on the basis of local contribution and State aid measured by the results of examinations; and therefore, if in our present Parliament subsidies from the State are opposed, we should little expect them to be opposed by the class to whom the whole system of endowments is dear, and to be advocated only by the class who as a general rule would leave every improvement to be worked out by the nation itself. I can understand the man who says that education is a personal matter, which every man must provide for his family by his own industry, and the poor are no exception, but who yet may, when facts are pressed upon him, make the poor an exception; but I cannot understand the economist who says, Benefit the rich as much as possible by endowments and exclusive universities, but it is an injurious system to aid the poor. And this appears to be the real state of the case. I advocate a consistent course. The *Times* says, speaking of the Commissioners' Report, "It is only a question of money. Who is to pay?" Precisely so; but I say, is it not conceivable that the poor may be so helped as to enable them to be the paymasters? It is not inconceivable that, by a judicious appropriation of the various endowments of the country, ample means would be available for every class and every locality. Let us, however, take in order the suggestions which have been made with the view of assisting the poor in the education of their children.

THE PROPOSAL TO ABOLISH TITHE.

First, some say, remove tithe, and then the farmers, paying less rent, will be able to give more wages. But without touching the question of the expediency or otherwise of tithe, without seeking to explain its origin, I would say that tithe has nothing to do with rent; the landlord and not the tenant pays the tithe. The actual payment is a mere matter of management, and involves no private or personal hardship. Of course if tithe were removed, and the landlord compelled to let his land so much cheaper, the tenant would be benefited, but what would this be but "a confiscation of the property of one class, and the distribution of it among another portion of the community? and it would be difficult to estimate the serious injury which an unjust confiscation of private property inflicts upon the well-being of a State." In these days there is much that is erroneous said about tithe. "It can be demonstrated that the incidence of tithe cannot possibly add one sixpence to the price of a quarter of wheat. The price of wheat depends on foreign markets, and cannot be the least affected by either rent or tithe." Rent is not an element of cost of obtaining agricultural produce; food would be no cheaper if all land were made absolutely rent free. Rents are increased by circumstances which diminish the expense of cultivation, but they mainly depend on increase or decrease of population, and wages are determined by the ratio between capital and the labouring population.

SUGGESTED INCREASE OF WAGES.

If we have a certain amount of the interest of our capital to spend on a given work, and four men have to be paid for it instead of three, the four must receive less wages, and therefore those, in the second place, who clamour for an increase in wages as a means of benefiting the poor, should reflect that wages follow laws—that wages can only be permanently raised by certain definite means. The idea of compelling farmers to pay more wages need not be considered. It is a popular notion, because it seems possible to recompense them by a reduction in rent, either by the removal of tithes or otherwise, but of this we have already disposed. "*Wages can only be raised* by taking from the profits of capital or from the additional wealth produced *by making labour more efficient.*" The latter method is the legitimate one, the one open to us all, the one which every man who wishes agriculture to progress has before him. No outlay pays better than that for labour judiciously expended. Let me cite an illustration from Mr. Nevile's pamphlet:—"A dispute once arose between my bailiff and my foreman on a field in my own occupation—

whether a field of beans would, or would not, pay for the hoeing a second time. I decided to hoe half this field a second time. I paid 4s. 6d. an acre for it. The produce was exactly a sack an acre more on the land hoed, which, at two guineas a quarter, gives a profit of 400 per cent. in four months." It also needs little to prove that the better the quality of the labour, the less it costs. I quote at length the Commissioners' remarks on a portion of Mr. Culley's Report (xxviii. 129, 130), for it establishes, what has long been known to all employers of labour, that the best article is the cheapest,—that an indifferent horse, a bad machine, a worn-out engine, had better be got rid of at once. Mr. Culley brings to light the striking fact that the cost of labour is upwards of 7s. per acre greater in Bedfordshire than in North Northumberland. Of the reduced cost in Northumberland, "some part," Mr. Culley states, "may be due to management, some part is due to the employment of a class of women almost equal to the ordinary run of Bedfordshire male labourers, and the remainder, which is no very small part, is due to the fact that the northern hind, at a slightly higher wage, is a much cheaper article." And the results to the farmer, the landowner, and the labourer, are as follows :—To the farmer, "it amounts to an ability to pay about 7s. an acre more rent, besides escaping with a much smaller poor-rate; to the landlord there is the difference of 7s. an acre greater rent as a compensation for building eight cottages (an obligation he cannot escape in Northumberland) and letting them rent-free, instead of building, or thinking he ought to build, fourteen, for which, if built, he would receive a rent amounting to a fair interest on the cost of eight." The net result to the landowners is an addition of £84 in rent upon every farm of 400 acres (the basis of Mr. Culley's estimate), after deducting the "fair interest" of seven per cent.

on the cost of eight cottages. To the labourer the result is still more important. Why the labourer in Bedfordshire is worse than in Northumberland, the writer in *Fraser* already quoted tries to account for in the following words :—One-half of the labourers in Northumberland were between the ages of fifteen and forty-five—only forty-two per cent. of those in Bedfordshire—and the proportion of old men to able-bodied was greatly in excess in Bedfordshire, doubtless because a large number of worn-out labourers returned thither from the manufacturing districts.

In Bedfordshire the income arising from employment in agriculture on a farm of the size above named, "amounts to £603, 4s., to be divided among fourteen families, giving about £43, 1s. 9d. to each ;" whereas in the other it amounts to £483, 16s., "to be divided among eight families, giving £60, 9s. 6d. to each." In Buckinghamshire the cost of labour per acre is, in some cases, higher than in Bedfordshire, and the contrast greater with that of the North ; while in Glendale, North Northumberland, the cost, as given by Mr. Culley, is £1, 3s. per acre, and in Bedfordshire £1, 10s. 2d. per acre. In Buckinghamshire cases are stated where "the cost of labour paid in wages on farms having the larger portion arable," was "over £2 an acre ; in the Valley of the Thames, in one instance, £2, 10s. per acre ; and in another instance, where the labour-books are well kept, and almost all the work is done by the piece, it appears to be £2, 5s." It is to be feared that much time must elapse before the majority of cultivators will understand the teaching of such an example as this. Progress can only be the work of time. Yet none can fail to observe that there are causes at work which must, sooner or later, affect the labour market. Railroads tend to equalize the price of labour as well as the price of food; agitators are among the agriculturists as among the operatives; men like Canon Girdlestone are pointing out how change of air is sometimes beneficial to the poor as well as the rich, that emigration may benefit the man who goes as well as the man who remains behind; and perhaps, above all, the law of settlement, which now throws the burden of providing for labourers in their old age on the localities which have been benefited by their strength in the time of vigour.

How is the Labourer to be Aided?

Let it be taken for granted, then, that the pecuniary condition of the agricultural labourer can only alter very slowly, and that at present he needs aid for the education of his children. How is it to be given? I am inclined to believe that our present machinery is very nearly sufficient, and therefore I would rather expand it than call an entirely new one into play. Yet it is to be feared that a more comprehensive one will be developed. Those were significant words uttered by Mr. Bright at Birmingham, on the occasion of his re-election, after accepting the Presidency of the Board of Trade:—"We have in all our parishes everywhere throughout the kingdom, organizations for the relief of paupers and for the punishment of criminals. I want to ask why, if these things can be done by the public will and by the fiat of Parliament, we cannot have at least as complete, and as widely sustained, an organization by which all our children shall be brought up in instruction and self-respect." Of course we can by the will of Parliament have any scheme forced upon the public; but there surely would be a departure from the doctrines of economical truth, if a Liberal Government were strongly in favour of legislative interference in things which may well be regarded as legitimate objects of private enterprise alone.

We have become familiarized with the idea that it is the duty of the State to teach drawing,—though why drawing, rather than music, or the other branches of a polite education, should be taught by the State, it is hard to say. The words of the President of the Board of Trade indicate that some general scheme will soon be brought forward for the acceptance of Parliament. If so, let us hope that it will be one which leaves undisturbed those parishes which are working in a good track, and only coerces those that are indifferent to the great and necessary work. Is it not possible to have a scheme by which the erection and the maintenance of a school would be compelled only in those parishes where none exists of a quality satisfactory to the Government inspector, and the management left to a committee chosen by a majority of ratepayers. This system would leave unmolested those parishes already provided with good schools conducted on principles dear to the inhabitants, and it might also be the means of causing the erection and support of schools in places where Government interference is dreaded; at any rate, it would have the merit of giving voluntary efforts full sway, while it stepped in and acted where apathy or ignorance reigned. The question still remains, If any scheme be sanctioned, who is to pay for its support?

AN EDUCATION RATE.

Will there be an education rate, and on what kind of property? is land to bear the entire burden? There are not a few to be found who say Yes, and who strengthen their position by the assertion that it is the neglect of the owner of land which has rendered State interference necessary. We are not many miles distant from a parish, nearly the whole land of which is owned by a nobleman of immense wealth, in which no school can be built, because his lordship will not even consider the subject. No land will he give, no money, no reply even to solicitations made with all the etiquette necessary in such matters. Cases such as these unfortunately exist, and are made the most of by those who ignorantly use the word "monopoly" to the possession of landed property; but they are not the rule; much has been done, much is being done, by owners of property, to help the poor to educate themselves; and we sincerely trust that by a vigorous and generous effort the enlightened among them, sensible to the duties attaching to the possession of large estates, will avert public attention from cases like the one quoted, exhibiting glaring misapprehension of duty, and save the country from compulsory education supported by an educational rate levied on land. The shrewd remarks of my friend Mr. Nevile, writing on the Irish land question, are very pertinent to the subject before us. He says, page 15, "If Lord A has 70,000 acres of land in Lancashire or in Galway, he may turn out every man, woman, or child on his estate, and make it into a deer-forest. In such a case I have not the least objection that Lord A should be declared a lunatic or a nuisance by a special Act of Parliament, but I strongly object, both on the grounds of justice and public policy, that ninety-and-nine sensible and useful landowners should be deprived of the management of their property to provide against a single lunatic or an accidental nuisance." It is the same with the educational question. If there are a few who ignore the duties of landowners, there are hundreds who do not, and are the many to suffer for the few?

ALLOTMENTS.

Assuming then, as I do, that a development and extension of our present system is all that is needed; assuming that the poor value a good education, and will *often* find means to pay for it where it can be got, it remains to inquire whether there are not ways by which the Legislature can indirectly aid the resources of the labourer, so as to put it in his power *always* to take advantage of the educational resources in his neighbourhood. The direct way, namely, by higher wages and better modes of remuneration, cannot be dealt with by the Legislature. This must be left to private adjustment, but the Commissioners put forth two very feasible schemes by which improved laws may aid the pecuniary condition of the agricultural labourers; the first is the allotment system, as it is called—that is, the allotment of such an amount of land to the labourer's cottage, or, in default of that, the assignment to him of such an amount of land as near to his dwelling as possible, as will profitably employ the leisure hours of himself and family without turning him into a small farmer, or leading him to place his chief dependence on the produce of his land and not on wages. This I consider the most legitimate, as it is the most hopeful, for it proceeds upon the soundest possible principles of political economy, for it "*tends to the production of additional wealth by making labour more efficient.*" The importance of this system cannot be over-estimated. For more than half a century thoughtful men having the interests of their country at heart have laboured to effect its extension, indeed, universal adoption. Pamphlets upon pamphlets were written on the subject from 1815 to 1820, and stronger language could not be used to set forth the imperious necessity than many able writers of that day adopted. Favourable testimony has again and again been given to Parliament in 1827, in 1830, in 1834, in 1843, and in the Report before us. Let us then glance at some facts connected with allotments. You are aware that two centuries ago there were large districts of uncultivated land over which the poor enjoyed certain rights. By the enclosure of these lands the labourer has been a direct pecuniary loser. Between 1760 and 1867 the poor lost no less than 7,000,000 acres of common, which they had formerly the privilege of using for their pigs, geese, and a number of other things—that is, nearly one-third of the total acres in cultivation (25,451,626). We cannot say that this removal of rights was done without a semblance of compensation. In all acts of enclosure these rights have been recognised, and provision has been made for a substitute, but unfortunately, in many cases, ineffectual provision, through one cause and another. In 1795, a Select Committee of the House recommended that in any general Enclosure Bill that might be passed, some regulation should be inserted "to secure for the cottagers as much accommodation in the use of land as they may have occasion for" (xxxiii. 161). "In 1806, the Rev. S. Demainbray, rector of Broad Somerford, Wiltshire, suggested that a clause should be introduced into an Enclosure Bill for his parish, assigning to every cottage in the parish, whether the owner had any common rights or not, an allotment of half an acre of land, to be vested in trustees to secure its proper use. The Act was passed in 1806, and the example was followed by almost every adjoining parish in that part of Wiltshire" (xxxiv. 167). And more than this, both in 1819, in 1831, and in 1832, Acts were passed to encourage and facilitate the letting of portions of land to cottagers, with a view to adding to their resources. So that we are not without testimony, 1st, that the necessity of the system has more or less been long recognised, and that, where tried, it has proved successful; and therefore it is no leap in the dark when we advocate its more general adoption. Experience has given us some facts connected with the system which it would be well to gather up:—

1st. A labouring man, even when his family is large, can seldom occupy more than half an acre.

2d. That the proprietor of the land should not exact more rent than he could expect to receive if he let his land to be farmed in the ordinary way.

3d. That all rates should be included in the rent.

4th. That the net profit of a quarter of an acre may be taken to be £4 for poor land, for good land, £5—*i.e.*, 2s. an average to each family (xxxvii. 191).

5th. That an allotment has no effect upon wages—is a clear addition to the labourer's means (xxxvii. 195).

I would here remind you that, in this very neighbourhood, we have testimony that the poor can profitably rent land at £20 an acre. Garden land, not one quarter of a mile from this room, is let to the poor at 2s. and 2s. 6d. a lug, the most convincing proof that it is worth in profit what we state, namely, from £16 to £20, for we know that it is good ordinary land which here brings in 30s., and if owners would let the garden land at 30s., the present poor occupier would have a yearly benefit of £18, 10s. per acre. Why owners of land should charge the rich man 30s., and the poor £20, can only be explained by the universal desire to make as much of property as circumstances permit; but without violating any principle of political economy,[1] I would say it is worth the consideration of any owner of land, whether he may not in the long-run greatly benefit himself by the present sacrifice of a few pounds of income. There is abundant evidence to prove that the moral and social advantages of this allotment system are immense. I cannot put the matter in more forcible language than that used by Sir Henry Fletcher, Bart.:—"The good is seen not only in the money it puts into the pockets of the labourer, but in the money it keeps there, in inducing him to go to his allotment instead of the public-house. It creates domestic habits very much—a man and his wife and his children can work at it together,—it raises the moral character, and causes a marked improvement in the internal economy and management of their cottages" (xxxvii. 194). And as regards the social aspect, "The effect of the allotments is to keep labourers and their families off the rates. Their moral character, their steadiness, industry, and skill, are greatly improved; crime becomes less frequent; their feelings towards those above them are greatly improved, and, what is of such importance to the farmer when labour is scarce, the attachments to home are increased, and the motives of the labourer for seeking the means of bettering his condition elsewhere are diminished" (xxxix. 204). It is much to be regretted that "a Bill amended from one of the previous Sessions, brought into the House of Commons by the Hon. W. Cowper, 1845, entitled, A Bill to Promote the Letting of Field Gardens to the Labouring Poor, which passed through the House of Commons

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[1] I have had to contend keenly for this statement with friends, being met with the assertion that the rent of the allotment ought to be what the poor in competition one with the other can afford to give, and not the rate charged for the agricultural land in the district, for that letting it under what might be obtained for it was absolutely letting it under its value, and, after all, only another way of giving relief to the labourer. This I cannot agree with. A starving man may be willing to give 8d. for a 4d. loaf, but surely the tradesman would not act rightly to sell it to him at that price. If the labourer is ready to give for his allotment twice or three times the value of the land in the district, it proves one of two things—either that he

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is cruelly alienated from the land, and is in the greatest need of it, knowing its worth to him and his family, or that land in general is let to the farmer far below its value.

I cannot see why a landowner should be required, on true political-economy principles, to exact from the labouring population say £4000 net for every 1000 acres, while for the same quantity of land he only secures £1500 net from large tenants. Yet many assert this.

and through the Lords a second reading, did not go to a third reading" (xl. 208). How sadly have the proposer's words on introducing the Bill been verified!—"Notwithstanding all that had been done, he believed that a generation might be expected to pass away before there would be a general allotment of garden ground for labourers."

Mr. Sotheron Estcourt's System.

I would refer you, in conclusion, to the description of the satisfactory working of the system as established by Mr. Sotheron Estcourt:—"About the year 1795, the livelihood gained of old in the neighbourhood of Tetbury by women and children, in carding wool, died out. My grandfather, the principal landowner, having occasion to stub up overgrown gorse-cover, hit upon a notion of letting it out to his neighbours; and after each had finished his quantum of the cover, he was allowed to rent it as an occupation for himself, his wife, and children, at odd hours. The field so let to the inhabitants of Newnton continues to be their garden ground still, and is in as good condition as any field in the village. The quantity held by one individual does not exceed a quarter of an acre, except in some few exceptional cases. I do not think our allotments have had any effect on wages. Almost all the labourers in the parish have an allotment. Many single women, living alone, have an allotment; all, indeed, except those who become disqualified by the receipt of parochial relief, which is, and always has been, a forfeiture of land. I do not think the farmers have ever used the allotment system as a means of getting work done more cheaply; they have no voice in the matter, nor ever have tried to interfere. The letting of an allotment rests entirely between the labourer and the landlord. I never heard any complaints by farmers of the labourers expending their strength on their allotments; on the contrary, our farmers see the moral good effects, and approve the system. It might be otherwise if our allotments, on an average, exceeded a quarter of an acre. There is no restriction as to growing corn. Most of our people grow corn in alternate years. There is no complaint about its encouraging pilfering. The labourers value their allotments greatly. They are held to be equivalent in value to the rent of their cottage. They struggle hard to avoid giving them up, and are often helped by the farmers and others in that struggle. There never is a single case of non-payment of rent, except where the man is about to give up his land altogether from poverty. The moral effect is great. It encourages industry; it occupies time which might otherwise be given up to the alehouse; it excites emulation in point of cultivation, which is increased by a horticultural society and prizes; it helps a man to keep a pig; it makes him a man of visible substance—something above the bare level of servitude; it draws a visible line between those who are in receipt of relief, and those who are independent; it occupies children; and is altogether a family concern. I will just add a remark or two. The merit of the system depends on two things: one, that the amount of land shall not be enough to convert a man from a labourer to a little farmer; the other, that the rule shall be at once and inevitably enforced which forfeits the land the moment relief (except medical aid) is applied for. The transaction of letting, with the choice of persons who shall have land, must be in the same independent hands as the land let to farmers, namely, the hands and absolute discretion of the landlord. A committee, or a society, or a vestry, would be fatal, for the letting would then be jobbed, or supposed to be jobbed."

REMARKS.

As special information, let me say that under the Enclosure Act now in force, 8 and 9 Vict. c. 118, we find that since 1845 to the present time 484,900 acres have been enclosed; out of these the Commissioners had power over 320,855, and the allotment to the poor has been 2119 acres, or ·66 per cent. (l. 286, 296). Now, calculating three labourers to each 100 acres, we have nearly 300 labourers for 66 acres of allotment—a very fair proportion. From the census of 1861, it is calculated that there are 745,977 agricultural labourers of twenty years and upwards, and that 233,117 acres would be required for half-acre and quarter-acre allotments, which, at £16 or £20 per annum, would amount to £2,729,872 per annum (xlii. 226, 229). Of course we are aware that many of these acres have already been allotted, but it is to be feared that these bear only a small proportion to the whole. The Commissioners suggest (233) that it would be highly desirable that a return of the quantity so allotted should be made from each agricultural parish at the same time that the annual agricultural returns are collected by the officers of the Inland Revenue department, under the direction of the statistical department of the Board of Trade. Surely a system which is seen capable of effecting an improved cultivation over 232,000 acres extra work done by labourers after they have finished their daily labour, while it stimulates industry and promotes morality, must also *increase the wealth of the nation.* Let us ever remember that the labour is *extra.* Without the allotment "the extra labour would never be expended." I would wish to make a few remarks also as to another depressing influence on the labourer, capable of alteration, although not by Parliamentary interference. "The absorption of the small farms in larger ones, has, in proportion as it has advanced, lessened his opportunities, and tended to deprive him of the hope of rising out of the condition of a day-labourer into one of importance and independence." While small farms existed, the labouring man might look forward to one as the reward of his industry and good character; it was to him "the attainable point of hope" (*Quarterly Review*, 1816). Since their extinction over many wide districts of the country, and the great reduction of their number everywhere, an accessible step in the social scale has been taken from him (xlviii. 269), and a wide gap has been created, which no exertion on his part can surmount. "The possibility of rising into a better condition kept him buoyant, and gave him motives for self-denial." While I entirely agree with Mr. Mill that "large farms, cultivated by large capitalists, and owned by persons of the best education which the country can give, persons qualified by instruction to appreciate scientific discoveries, and able to bear the delay and risk of costly experiments, are *an important part* of a good agricultural system," I do contend that there should be farms of all sizes, adapted for the capabilities of various persons.

"I am friendly to a few small farms in a district, not because I deem them profitable in a national point of view, but because they serve as steps in the ladder for men of small means and industrious habits to mount by" (*Memoir of John Grey of Dilston*, p. 258).

"If all the agricultural land of any country is thrown into large farms, you have three distinct and widely separated classes—landlords, tenants, and day-labourers. It is then most certain that the whole class of agricultural labourers must be for ever hopeless.. It is simply impossible for any of them to rise in the world or better his condition. A long life of self-denial and industry can only lead, at best, to a blue coat and brass buttons, prize-card for bringing up a family without parish relief, and the honour of saving the parish rates for a time by some very hardly earned savings." Persuaded as I am that sound political and social economy must lead to general happiness and prosperity, I can never believe that the large farm system, *universally* adopted, can be correct. Caird, in an address lately delivered in London, says that the large farm system produces nearly twice the proportion of corn, and half the proportion of green crops; that is, is doubly dependent on the price of corn as compared with the small farm system, which relies to a greater extent on its dairy, cattle, vegetables; the result being that the small farm system pays one-third more rent and a higher rate of wages to the labourer—agreeing with the fact which we find, namely, that small farms prevail in coal and large farms in chalk districts, and that in the former wages are higher and rents are higher. And the writer in *Fraser* before alluded to (Mr. J. T. Harrison, C.E.), after a careful and elaborate investigation of the labour question throughout England, arrives at the following conclusion:—"We are thus able to construct a scale for the different systems of agriculture according to the relative amount of labour which they require. Taking the various systems, and proceeding from that which employs the minimum to that which employs the maximum of labour, we rank them in the following order:—1. Stock-rearing in mountainous districts; 2. Summer grazing; 3. Sheep-farming on light land; 4. Cheese-farming; 5. Corn-growing farms with still feeding; 6. Dairy farms for supplying milk and fresh butter to large populations. If the general complaints as to the scarcity of good servants are true, we are ourselves to blame—the small holdings were the nurseries where good servants were reared" (xiv. 53). It was in families of the small occupiers of this class that the best farm-labourers used formerly to be trained. "We have destroyed nearly all of them, and have left nothing but the everlasting 8s. or 10s. or 12s. a week, and the union workhouse, a system which has no reward for carefulness and frugality, and no punishment for extravagance and waste." I would say, then, in the words of the Commissioners, that the gradual alienation of the class of labourers in agriculture from the soil, "which has been going on for the last hundred years, cannot be overlooked or treated otherwise than with the deepest sense of its importance in any inquiry having for its object, as this inquiry has, the intellectual and moral benefit of the agricultural labourer."

COTTAGES.

The Commissioners suggest another practical method by which the poor man's resources may be increased, or at least "one of the causes which tend to degrade him removed," namely, better cottage accommodation. Improved cottage accommodation is a necessity of the age, but not to the extent advocated by some. The kitchen-and-parlour system is unnecessary for the poor; they neither need a parlour nor do they like one. The suggestion made by the Commissioners, that the bedrooms, as much as possible, should be built on the ground floor, is good, for by this means not only is fuel economized, but mothers are able to attend to babes or sick children while engaged about necessary household duties. Although it is always wise to try to act up to a high standard, it is difficult to do this against the direct prejudices of classes. I was much struck on going over the farms belonging to Greenwich Hospital on Tyneside, and inspecting the new and improved cottages built under the direction of the late Mr. Grey of Dilston, to find that, do what he might, he was unable to prevail upon the labourers' wives to leave their beds in the bedrooms upstairs. In every cottage we entered, we found that the beds had been imported into the kitchen below, while the well-sized bedroom above was left with its floor covered with potatoes, or onions, or some other vegetable or fruit. The great difficulty in the way of good accommodation is said to be the unremunerative character of the necessary outlay, so that until cottages can be built for something like £100 apiece, to ask a landlord to lay out thousands in building cottages is asking him to expend his money for the moral elevation of his tenants. There are many arguments which can be adduced to show that a return nevertheless is obtained, that farms become more valuable, that better tenants are attracted, who aggregate around them better labourers, and thus ultimately rates are lessened. But these benefits are remote, and therefore, although there are hundreds of large-minded proprietors who do so view the facts of the case, it is questionable whether the majority is convinced. "The evidence received by our Assistant-Commissioners, in every county hitherto visited by them, proves that many landowners, both large and small, have, especially within the last thirty years, expended in the aggregate immense sums of money in improving and enlarging old, and providing new, cottages on their estates (liv. 320). In exceptional cases, cottages satisfying the requirements of health, decency, and comfort have been constructed for £100, or even less, where a judicious use has been made of local materials, or where the ordinary materials and labour are unusually cheap; but in general the cost has ranged from £105 to £140 (lvi. 322). A friend writes:—"I made excellent bricks at 16s. 6d. a thousand, including everything. The last pair of cottages I built have a good kitchen, back-kitchen, larder, and all offices, and five good bedrooms—three for one cottage, and two for the other. They cost me £160 the pair, and let at £4 the one and £4, 10s. the other. This is a shade over five per cent. The tenants pay a full rent for their garden ground in addition. When people say cottages are a bad investment, what do they mean? That the Mexican loan pays ninety per cent.? You cannot buy land as an investment to pay more than three per cent. on an average. All I say is, that my cottages are good, the tenants wish nothing better, and they pay more net interest than any sound investment I am aware of. Half an acre of garden is the least that I allot. I get outside rent for the better house; the health, the happiness, the morality of my labourers are all extra." Since this was addressed to me, the writer has laid his experiences before the public, and to show the eagerness with which persons grasp facts, I may mention that the first day after the appearance of the letter in the *Times*, there were sixty-seven applicants for plans, and more letters than Mr. Nevile could answer.[1] The Commissioners call public attention to the use of concrete in building cottages, as adapted by Mr. Nicoll and Mr. Tall, methods holding out very considerable expectations that cottages may yet be built for the labourer which shall yield a fair percentage in rent. Plans of cottages are appended to the Report. A three-bedroom cottage is said to be built for £85 to £105, a two-bedroom for £60 to £70, a double two-bedroom for £120. "Being of great solidity and strength, proof against fire, and impervious to damp, no appreciable sum need be calculated upon as necessary for repairs; therefore, as it is pointed out, a rent of eighteenpence a week, seventy-eight shillings a year, would pay within a fraction five per cent. per annum, which may fairly be considered a full return, on the presumption that the structure is as durable as alleged" (lviii. 334). Specimens of Mr. Nicoll's cottages can be seen at Twickenham, and near the Falwell station, two miles from Twickenham. An apparatus, patented by Mr. Tall, for constructing houses in Portland cement, obtained the gold medal at the Paris Exhibition of 1867. The Superintendent Architects of the Metropolitan Board of Works in reporting on it say "that the cost of the patent apparatus would in the case of a single house form a large item in the estimate, but it might happen where a great many houses of the same dimensions or form are to be built, that the price of the apparatus, added to the cost of the concrete, would come to less than the price of brickwork" (lix. 341). Mr. Newton, C.E., also, who has constructed buildings with it, states that he does not think it applicable to cottages unless built in considerable numbers together. I believe that these two suggestions are most important, and, if acted upon largely, cannot fail to be productive of most beneficial results. These, with other social energies at work, will help the labourer to the better discharge of his duty towards his offspring. I hold it to be a fatal error to assume that the duty of educating the children of the poor devolves upon any but themselves. And, therefore, although alive to the fact that had it not been for the clergy of the Established Church, aided by the State, unsatisfactory as the present state of education is, it would never have been what it is; that to them must be accorded, in hundreds of cases, not only the establishment, but the present success of village schools; yet I fear they are apt to be like the over-generous old lady, whose house is thronged with mendicants—they are apt to stifle from their over-exertions the native self-reliance of the poor. Through an earnest desire to do good, they become over active. In how many parishes, I would ask, do parents not consider that they oblige the parson by using his school? I hope that this will not be misunderstood. It is no doubt the better side to err on—better to be too anxious and too energetic than the contrary; but it has always struck me as faulty to purchase the attendance of children at school by doles or any indirect means. No better proof can be adduced of the part lately taken by the clergy of the Church of England in the education of the poor, than that which may be gathered from the last Report of the National Society (1867).

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[1] See Appendix for Plan and Specification.

It appears from the Report of the Royal Commission, that in the case of 168 schools, while the clergy contributed at the rate of ten guineas each, 399 landowners, with a total rental of £650,000, contributed five guineas each. In 3000 schools, the deficit income supplied by the treasurers amounted to no less than £52,777, or an average of £18 for each—the treasurers in most cases being clergymen.

He who wisely estimates the great want of the poor of England will not ignore the first essential—self-reliance, for the absence of which nothing, I believe, will compensate. That clerical parochial oversight is the best which develops and aids self-effort without superseding it. If there be in Scotland, as is generally assumed, a greater avidity for knowledge among the poor, if cases are quoted, as in the Commissioners' Report, of what may be termed the marvellous determination of the Scottish youth to obtain learning, I am a little inclined to trace the cause of this to the religious system under which they are brought up,—a system perhaps inapplicable to the southerner, yet highly conducive to the development of individuality.

FIELD LABOUR OF WOMEN.

After all that has been said, it is almost self-evident, that to be true to these principles one cannot advocate legislative interference with the labour of women. Whether field-labour be conducive to their well-being or not, they, and they only, or their husbands, must have the control of it. In the Report before us, the evils incident to it are distinctly stated; nor can any one be blind to them. The woman who works in the field is placed in a position favourable to her becoming coarse and unwomanly,—if single, indisposed to enter domestic service, if married, to neglect her children, to have an untidy uncomfortable house, and this is the indirect means of driving her husband to the alehouse (Mr. Fraser, x. 24; Mr. Norman, xxxvi. 120; Mr. Portman, xxiv. 108). Such is one side of the picture.

Another, and a more pleasing one, is given us from Northumberland:—"There are many who hold the opinion that field work is degrading, but I should be glad if they would visit these women in their own homes after they become wives and mothers; they would leave the cottage with the conviction that field work has no degrading effect, but that he has been in the presence of a thoughtful, cultivated, unselfish woman." The Commissioners' opinion is that it does them no harm, physically or morally. This is the county in which female labour is perhaps seen to the greatest advantage. The general custom is for the women to cease field work when they marry. And perhaps, were testimony gathered from every district in England, it would be so various as to perplex the clearest head,—for witnesses, without intending it, are the victims of prejudice. We too frequently believe what we wish to believe; so that the difficulties of legislating on such evidence would be immense. But I hold that not only has the Government nothing to do with it, but that it is an evil, if an evil, which will cure itself. Let the husbands' and the children's earnings be better; we shall find women absent from our fields, except in those pleasant times of the year when the most soft-hearted philanthropist would hardly forbid their presence,—haymaking and harvest. How is it in those parts where wages are high? say in Hampshire. Of the women in this county, one speaker the other day, Mr. Chute, said, "They had few women, especially young girls, employed on their farms. It was the most difficult thing to obtain the services of a woman." Mr. Trash said they might take it for granted that few women were employed in Hampshire. Mr. Stanhope (xviii. 71), "There is a growing disinclination to field work among women themselves." A careful study of the census shows us, that while on the whole, in Scotland, Wales, and Ireland, the number of women employed on each hundred acres has diminished in the last ten years, in England it has increased—although in most of the separate counties the number has either remained stationary or diminished; the considerable increase in the counties of Cheshire, Northumberland, Lincolnshire, and Cambridgeshire, having raised the total. When we come, however, to the question of forbidding women to work in the field, we are forced to ask, Will any one explain what equivalent the married woman, who is forbidden to work in the field, is to have for her 4s. a week thus lost? Or who is to support the large number of single women dependent on their own exertions, if debarred from field-work?

FIELD LABOUR OF CHILDREN.

In the case of children under a certain age, there may perhaps seem a cause for legislative interference. We believe that the Factory Act has in a measure worked beneficially, and there appears to be some ground for supposing that the Printworks Act might be extended to agricultural children, "modified and made elastic enough to meet the necessities and vicissitudes of agricultural operations" (xxx. 141). The most feasible plan for obtaining continuous education appears to be to fix an age below which no child shall go for hire, with or without compulsory attendance at school, to require a certain amount of school attendance from that age to 13 or 14 years of age, and perhaps, in addition, the production of a certificate of such school attendance before hiring (Mr. Portman, xxii. 102). Interference is wanted, not so much to prevent cruelty to children, as to secure for them that elementary instruction which is considered essential to their well-being. It seems to be generally allowed by farmers in all parts of England that the limitation to ten years could be made without hardship to the parents or inconvenience to the farmer. And if this be so, it is quite within the province of Parliament so to legislate—for there is a limit within which even liberty must be controlled. Between 1851 and 1861 the number of young persons employed in agriculture under ten years of age had increased by one third, rendering the efforts of educators still more arduous.

SUMMING UP.

To sum up, let Parliament do everything in its power to elevate the status and increase the comfort of the poor man, by facilitating the erection of good cottages, and certainly by the allotment system; let every Act be passed which can encourage the development of greater individual effort; but may the country be defended from the appropriation by Government of duties which belong to individuals, as individuals, as parents, and which, if not fulfilled, are neglected mainly because of the unequal distribution of property, a subject far more worthy the attention of Parliament, and one certainly more capable of alteration! And therefore, as almost a corollary to this, we deprecate the interference of law to restrict women or unduly children from working in the fields. The true remedy, as in the aforesaid subject, is to raise the poor above the necessity of it. In their present condition it would be cruel and almost unjust (xlix. 272) to forcibly diminish the joint earnings of a family. Let the condition be improved, and I believe the evil will vanish.

APPENDIX.

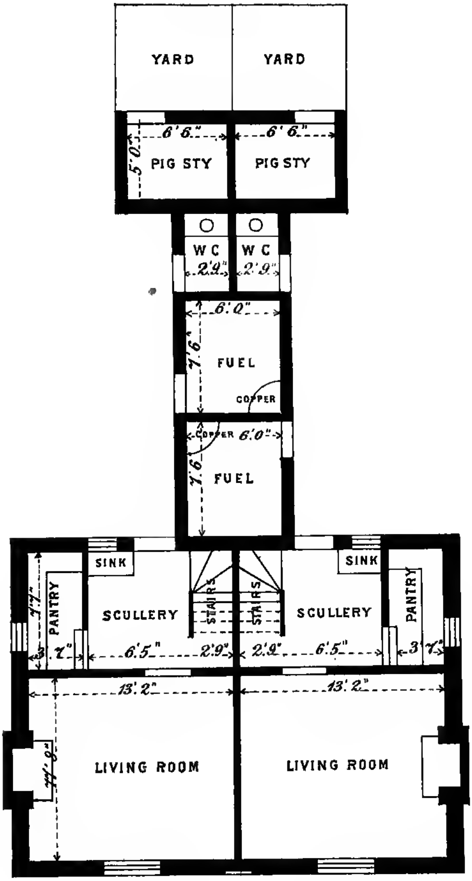
AGRICULTURAL COTTAGES.

To the Editor of the Times.

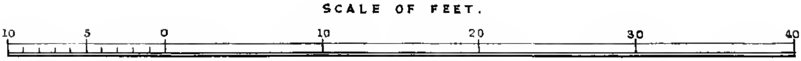
Sir,—Two points have for many years been put very strongly before the public—the pauperism and immorality arising from bad cottages, and the fact that good cottages do not pay. I will say nothing as to the immense indirect loss from the wretched hovels of which we read so much. I will say nothing as to Christian principles *versus* the rate of interest, but I confidently expect, after forty years' experience, that very good agricultural cottages, judiciously built, will pay as high a rate of interest as any other investment equally secure. I have lately built a double cottage as good as any labourer in one of our best paid counties need wish to live in. They cost rather under £170 per pair; they are let to pay 5 per cent., which is rather more net interest, calculating everything, than buying either land or consols. The great difficulty has always been as to the three sleeping-rooms. Either the living-room and scullery must be larger than necessary or the bedrooms must be very small indeed. If half the number of cottages have three bedrooms and the other half two, the supply of bedrooms is ample; and an idea struck me that a pair of cottages might be built having five bedrooms, the middle bedroom being thrown to either cottage as required. This arrangement has been admirably carried out by Mr. Goddard, architect, of Lincoln. These cottages have been examined by the Principal of the Royal Agricultural College, Cirencester, and by one of our largest land-agents, and they have both expressed a most favourable opinion of them. They have everything an agricultural labourer can want, and nothing he does not want.

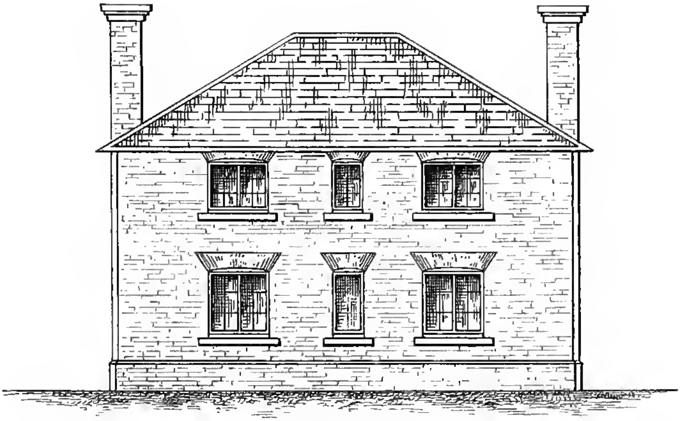
DESIGN FOR A PAIR OF COTTAGES.

Estimated Cost £170.

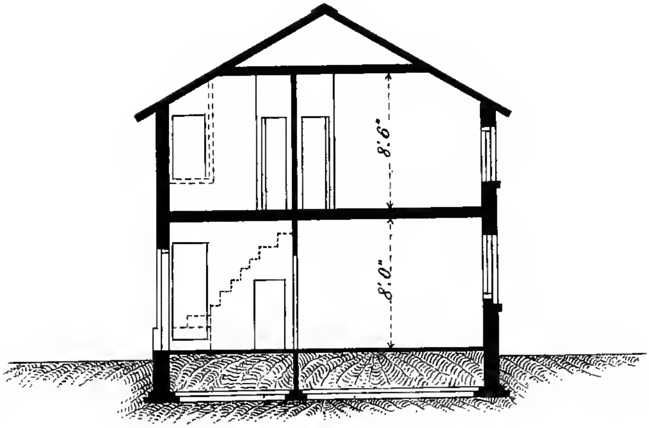


GROUND PLAN.





FRONT ELEVATION.



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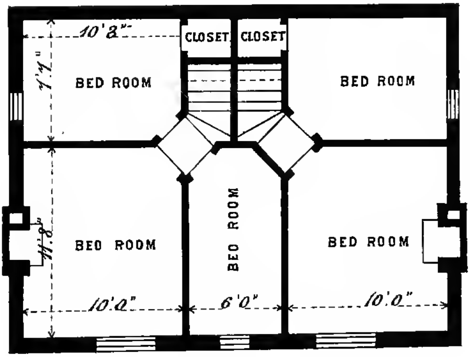

CHAMBER PLAN

GODDARD & SON,
ARCHITECTS, LINCOLN.

I allot to all my cottages half an acre of garden ground at a full rent, they all pay 5 per cent. on the cost, and in forty years I have never lost one shilling by any arrears. I am persuaded that not one of the tenants would accept a cottage two or three miles from his work without a garden rent free, and this disposes of the objection that with low wages these rents cannot be paid. Some years ago I made a great number of bricks at 16s. 6d. per 1000, and as I paid 22s. per 1000 for the bricks in these cottages, 5s. 6d. per 1000 might have been saved. A plan and detailed account of cost can be obtained of Mr. Goddard for 5s., including postage, and all the work was done by measurement and valuation, and not by contract. I shall be happy to show them to any one,—Yours,

CHRISTOPHER NEVILE.

THORNEY, NEWARK, *May* 24, 1869.

ESTIMATE FOR BUILDING A PAIR OF COTTAGES.

Rds.	Yds.	Feet.			£	*s.*	*d.*
	34		Cube.	Digging, at 4d.,	0	11	4
7½			Sup.	Common brickwork in mortar, at £7, 10s.,	56	15	0
	26		„	Brick flat paving in sand, at 1s. 4½d.,	1	15	9
	49		„	Floor brick paving laid in mortar, at 2s.,	4	18	0
			4	Fire grates and settings, with hearth-stones, etc., complete,	5	0	0
				Whitewashing and sundries,	0	10	0
	283		Sup.	Render and set walls, at 5½d.,	6	9	9
	199		„	Lath plaster and set ceiling, etc., at 11d.,	9	2	5
			6	3-inch tooled stone door sills, at 2s. 9d.,	0	16	6
			12	Do. window do., at 4s.,	2	8	0
			2	Do. chimney caps, at 5s.,	0	10	0
			2	2½-inch self-faced covers to vaults, at 2s. 3d.,	0	4	6
			2	Small sink stones, at 10s.,	1	0	0
		1410	Sup.	Slating, at £1, 5s.,	17	12	6
		115	Run.	Ridge tile, at 5d.,	2	7	11
		144	Cube.	Fir in lintels, plates, floors, and roofs, at 2s.,	14	8	0
		375	Sup.	Studded partition, at 10s.,	1	17	6
		484	„	1-inch white wood straight joint floor, at 23s.,	5	11	6
		290	Run.	3½ × 1 square skirting, at 2d.,	2	8	4
			11	Window frames, at 14s.,	7	14	0
			17	Doors and Frames, at 13s.,	11	1	0
			2	Staircases complete, with boarded spandrils, at £3, 15s.,	7	10	0
			2	Privy seats, risers, and bearers,	0	8	0
			2	Forming yards of pig styes with wood railing,	2	0	0
				Sundries, including shelving, etc.,	2	0	0
				Painting,	5	0	0
					£170	0	0

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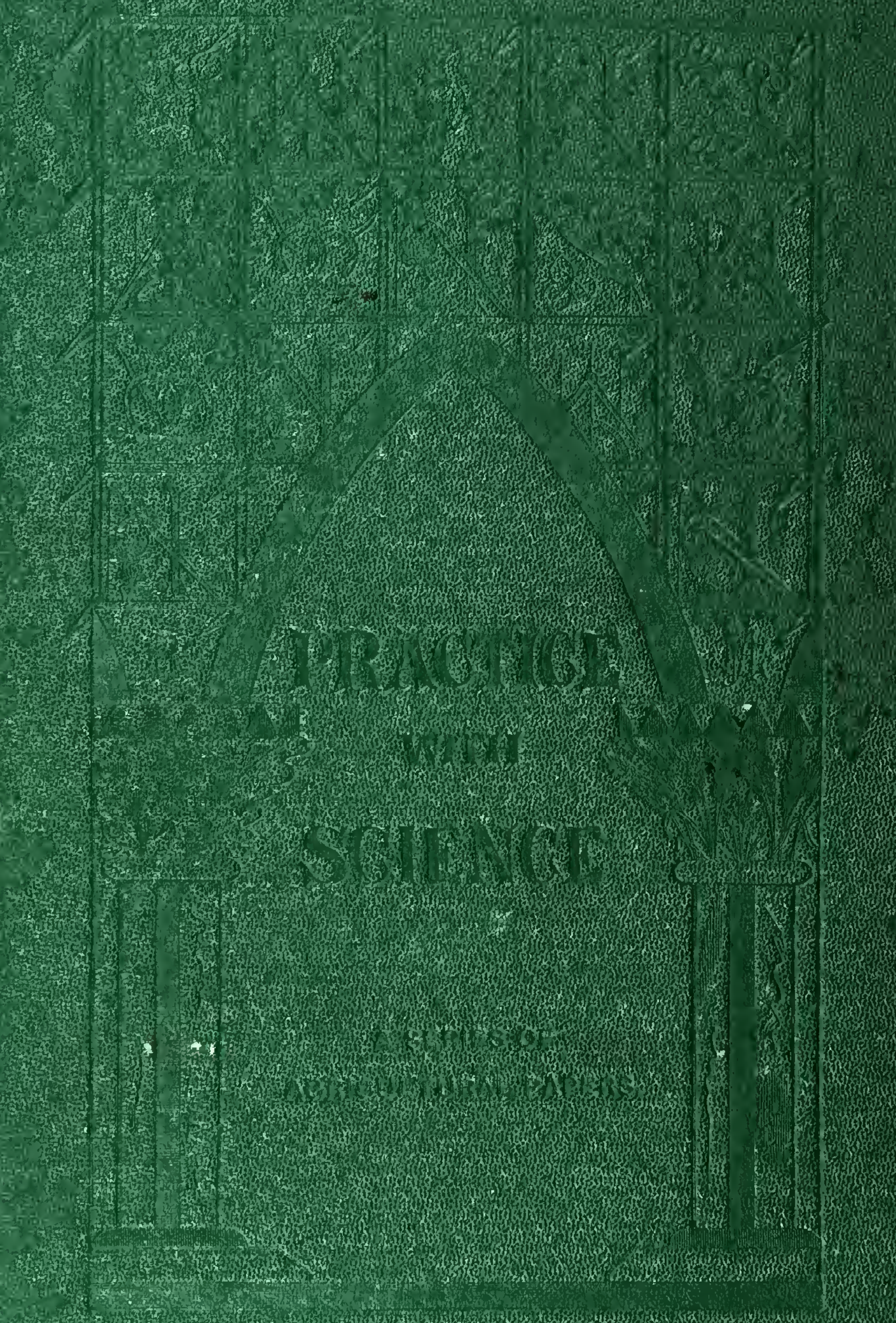

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